PUBLIC HEALTH

REPORTS AND PAPERS

PRESENTED AT THE MEETINGS OF THE

American Public Health Association

IN THE YEAR

1873

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INTRODUCTORY NOTE.

By the Secretary of the Association.

On the 18th of April, 1872, an informal conference of a number of gentlemen, who for several years had been in some degree co-workers in the studies of Preventive Medicine and in duties of public sanitary service, was held in the city of New York, with the design to secure concerted effort, and establish some adequate plans in the cultivation of hygienic knowledge, and procuring more effective applications of sanitary principles and laws. The committee which was appointed at that conference submitted a plan of organization at a subsequent meeting, held on the 12th and 13th of September, 1872.

At the first conference there were present several representatives of the public health service, with other contributors to sanitary improvement, from five cities and as many States. Harmonious and definite views of duty prevailed. At the meeting for considering the report of the committee, in September, there were members from three additional States and as many cities; thus the conference for organization represented active promoters of sanitary work in New York, Pennsylvania, the National Capital, Louisiana, Rhode Island, Connecticut, Ohio, and Illinois; while from numerous other States aid and counsel from members not in attendance were also received. The plan of organization then adopted with entire unanimity was slightly modified in some minor particulars at the Annual Meeting held in November, 1873, in New York. The Constitution, as printed in this volume, shows what the Association is, and what it proposes to do. The reasons for making it a strictly voluntary organization whose autonomy shall not be ever fluctuating or be annually changed and even lost by any system of merely nominal or delegate membership, will be obvious to all co-workers in the fields of scientific inquiry and organized permanent plans of unofficial and yet public coöperation. The membership of the Association, as provided by its Constitution, in Article III., is secured upon the basis of personal devotion to sanitary studies and their practical applications. The greatly increased interest in sanitary knowledge and its manifold applications, with an enlarged spirit of scien-

tific inquiry which has begun to apply itself to the economical and social interests of mankind, already insure a numerous membership and the harmonious working of the Association. Independence of official and governmental relationships the better secures for this body and its beneficent objects the membership and counsel of the chief promoters of sanitary works and of the ablest contributors to practical knowledge in the leading boards of health.

With such membership and means to pursue comprehensive and definite lines of sanitary inquiry, this body has now nearly completed its second year without attempting to enlist for its work and purpose any other support than has spontaneously resulted from this harmonious alliance of earnest men in a voluntary system of organized inquiry and conference. The first meetings of the Association have resulted in the cheerful contribution of reports and papers upon important sanitary questions, rather than in voluble debates ; the rich fruit of careful observation and study, comprehensive surveys relating to epidemics and other diseases, and logically studied truths which are required for the basis and structure of true sanitary science and for the most effective methods and proceedings in public health administration. This manifestation of cheerful willingness to observe, to study, to glean facts in vast fields, and to report and compare all such results, is characteristic of the true physician and the assiduous student of the kinds of useful knowledge by which all the higher interests of society are promoted. These voluntary and painstaking inquiries by a great number of scientific gentlemen in the midst of arduous professional labors, the latest and best fruits in the fields of science reviewed in discourses like those pronounced at the meeting in New York by Dr. F. A. P. Barnard, and Hon. A. D. White, the respective Presidents of two universities, and the elaborate and suggestive discourse of General Walker, the Superintendent of the Ninth Census, upon some of the relations of nationality to the death-rates, and the reports upon united personal and official inquiries respecting the chief epidemics of the year 1873, are the first offerings to the Association.

In this volume of selected contributions to sanitary knowledge, will be found a fund of useful and trustworthy facts and conclusions which possess permanent value. It is the chief object of this publication to exemplify and emphasize the practical uses of methodically and voluntarily garnered elements of sanitary truths and common knowledge which most concern mankind. In this timely and unselfish work the best of physicians and the most earnest and philosophical of public teachers, leaders of thought and useful public action, cultivators of special branches of physical knowledge and of the arts that affect the social and sanitary state, have heartily united. No limitations of the

guilds of special vocations, no fear of professional apathy in any one of the skilled professions, no timidity to espouse the cause of the helpless, the ignorant, and the poor, classes whom pestilences destroy whenever they arise, whose unhealthful homes are hunted out by every epidemic, and who need the safeguards of hygiene, — the common blessings of fresh air, wholesome food, and pure water, — no indifference of local governments, and no fatalism of the common people or their teachers, will deter such advocates of sanitary improvement from pressing forward the work they have undertaken.

The golden maxim of Franklin that "Public Health is Public Wealth," is obviously true in all communities, but the same maxim now finds a higher significance in the ascertained relationship of sound and vigorous health to the social and moral interests of individuals, families, and nations.

The chief problems of civilization and humanity now demand their solution upon a basis of most exact and comprehensive knowledge of facts reduced to the deductions and formulas of science, and it is not arrogating unreasonable functions for the principles and the public applications of sanitary science, to say that the physiological health of the people so far underlies soundness and sufficiency of mental culture that hygiene will have to be recognized as a fundamental element of success in common education and in the higher culture, as well as in the practical solution of the great social and moral problems of our times. Not only is the old doctrine of the "*Mens sana in corpore sano*," an axiomatic truth, but it is equally true that the circumstances, habits, daily duties and observances that secure personal and public health, are in themselves powerful means of mental and moral training, and of mental and moral health, which may not be disregarded without infinite harm to individuals, to families, and to society at large.

Whether, therefore, the humane physician, the moralist, the educator, or the public economist and statesman estimate the practical bearing and value of hygiene and the applications of sanitary science, the motto of the astute Mr. Disraeli, "*Sanitas sanitatum, omnia sanitas*," finds a world-wide and cogent application. Even in the most advanced view of the relations of hygiene to education and social culture, the moral and religious consequences of a faithful performance of sanitary duties conspicuously appear, for, in the well chosen words of President White, whose discourse is published in this volume, "The only wholesome fear is not that fear based on mystic dread of tyranny, but fear to violate those great laws by which the Divine Power which maintains and regulates this universe, governs all. That is the fear which lies at the beginning of wisdom, and among those studies calculated to impress upon us the existence of laws, the violation of which is followed by penalties strictly im-

posed, stand foremost those to which this Association is now so worthily devoting its attention — studies which help to make this earth more beautiful, and mankind more reverent and noble."

In this volume of Sanitary Papers the records of two deadly epidemics, — the fatal strides of cholera in the great valley west of the Alleghanies, and the invasion of Shreveport and Memphis by yellow fever when those cities were utterly defenseless, unguarded, and unpoliced, — the description and exemplification of successful methods of preventing the progress of pestilences by stamping them out, the mapping out of the course of epidemics, and the demonstrated progress of science which is destined to grapple successfully with the combined factors of epidemic and other preventable diseases, show how great are the tasks and the triumphs which Preventive Medicine has proposed. Though these separate contributions to the Association's fund of information are spontaneous offerings, the opinion of all who read these Papers must be that the time is near when neither the State nor National authority and support will be justifiably withheld from local and general inquiries and from the devising and maintenance of measures for the general defenses of life and health, which localities, classes, and particular occasions demand. In this view State Medicine is not a chimera, and State interference would not be inconsistent with the most liberal and just government of a free people. But the progress of knowledge and the development of sanitary science have not waited for the aid and direction which the State might give. The sacredness of human life, the value of health, the claims of humanity, and the requirements of the beneficent laws of nature have incited a great number of educated and public-spirited men in the different walks of life to give attention to sanitary knowledge and to aid in applying it. In this way physicians and medical officers in numerous cities and large towns have received the cordial coöperation of members of every skilled profession.

Sanitary officers and boards of health have to perform their duties under laws which, in most of the States, are not worthy of an enlightened people. A sanitary system worthy the present state of the physical sciences and of hygiene hardly has existence in any of the States. But in eight States a central Board of Health has begun its work of inquiry and the framing of a project of public health laws, a parliamentary commission in the Dominion of Canada is at present devising a sanitary code, and in nearly half of the States of our Union efforts to secure good laws and a sanitary system have commenced. Certainly it is not in vain that the American Public Health Association pursues its voluntary inquiries and now presents these contributions to a great cause in which philanthropists and statesmen are enlisted as co-workers with medical and sanitary authorities.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECT.

II. The objects of this Association shall be the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene.

MEMBERS.

III. The members shall be selected with special reference to their acknowledged interest in, or devotion to, sanitary studies and allied sciences, and to the practical applications of the same. They shall be elected as follows: —

Each candidate for membership shall first be proposed to the Executive Committee in writing (which may be done at any time), with a statement of the business or profession, and special qualifications of the person so proposed: on recommendation of a majority of the Committee, and on receiving a vote of two thirds of the members present at a regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and a Second Vice-President, a Secretary and a Treasurer.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or, in his absence, one of the Vice-Presidents, or, in their absence, a Chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all Committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the Correspondence and Records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and

place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association ; and shall give notice to the several officers, and to the Executive and other Committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments ; and, at each annual meeting, render the same to the Association, when a Committee shall be appointed to audit his accounts. If from the annual report of the Treasurer there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

COMMITTEES.

VIII. There shall be a standing Committee, to be known as "the Executive Committee," which shall consist of the President, the First Vice-President, Secretary, and Treasurer, and six members annually elected by ballot.

All Committees, and all members preparing scientific reports or papers to be laid before the Association, at its annual meetings, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least six weeks preceding the date of such meeting, to secure their announcement in the order of business.

EXECUTIVE COMMITTEE.

IX. It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association ; to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses ; to consider all applications for membership, and, at the regular meetings, report the names of such candidates as a majority shall approve ; and, generally, to superintend the interests of the Association, and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association ; such notice shall contain the order of business to be followed at said meeting, and briefly, the subjects to be presented, and the special points of discussion.

MEETINGS.

X. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of By-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given, by circular, to all the members, together with the order of business.

QUORUM.

XI. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the Constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XII. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION.

XIII. No alteration in the Constitution of the Association shall be made except at an annual meeting, and unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

OFFICERS AND MEMBERS OF EXECUTIVE COMMITTEE.

[*Elected September* 13, 1872.]

STEPHEN SMITH, M. D., *President.*
EDWIN M. SNOW, M. D., *First Vice-President.*
C. B. WHITE, M. D. *Second Vice-President.*
JOHN H. RAUCH, M. D., *Treasurer.*
ELISHA HARRIS, M. D., *Secretary.*

CHRISTOPHER C. COX, M. D.
HENRY HARTSHORNE, M. D.
WILLIAM CLENDENIN, M. D.
FRANCIS BACON, M. D.
MOREAU MORRIS, M. D.
JOHN M. WOODWORTH, M. D.

OFFICERS.

[*Elected November* 13, 1873, *under the Amended Constitution.*]

President, STEPHEN SMITH, M. D., New York.
First Vice-President, EDWIN M. SNOW, M. D., Rhode Island.
Second Vice-President, C. B. WHITE, M. D., Louisiana.
Secretary, ELISHA HARRIS, M. D., New York.
Treasurer, JOHN H. RAUCH, M. D., Illinois.

EXECUTIVE COMMITTEE:

ELECTED MEMBERS.

EDWARD JARVIS, M. D., Mass.
MOREAU MORRIS, M. D., N. Y.
J. J. WOODWARD, M. D., U. S. A.
S. O. VAN DER POEL, M. D., N.
J. M. TONER, M. D., D. C.
A. N. BELL, M. D., N. Y.

I.

REPORTS UPON PHYSIOLOGICAL SUBJECTS RELATING TO HYGIENE.

ON THE LIMITATIONS AND MODIFYING CONDITIONS OF HUMAN LONGEVITY, THE BASIS OF SANITARY WORK.

AN ADDRESS DELIVERED AT THE OPENING OF THE FIRST SESSION OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, CINCINNATI, OHIO, MAY 1, 1873.

By STEPHEN SMITH, M. D.,
President of the Association, of New York.

GENTLEMEN : — We inaugurate to-day the American Public Health Association, the objects of which are " the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene." The field of labor upon which we enter is most inviting to the student of social science and to the philanthropist, for it embraces the highest interests of man and of human society. In its broadest acceptation, sanitary science aims to secure to each individual the most perfect type of the species, immunity from disease, and death from old age, or the natural decay of the structures and. functions of the body. The most superficial view of our race discovers the value of a science having such aims, and the momentous task which it proposes to accomplish. On every hand we witness the most prodigal waste of human life. Inheriting as a birthright health and longevity, we find that man lives but a moiety of his days. Of the children born, what vast percentages never see the anniversary of their birth ! What other large percentage dies under five years ! How few, comparatively, reach the age of ten ! At twenty the generation has dwindled to an insignificant minority, and at thirty-three to forty-five it disappears altogether. And even during his short and uncertain life, what physical evils cling like an inheritance to man's body, soul, and estate. His form is distorted with every conceivable deformity, and disease in protean shape preys upon every structure. His mind is often dwarfed to that of the meanest animal, and his moral perceptions may be so dulled and perverted that he has no knowledge of right and wrong. He voluntarily destroys every vestige of manhood by yielding to the most degrading passions, and by poisonous compounds of his own invention reduces himself to the condition of a helpless or an infuriated brute. He wrests from his fellow by fraud and chicanery the just allotments of property, and in turn has his own estate torn rudely from his grasp by the rapacity of a neighbor.

As we contemplate human society in its various stages of development, from that of the savage to the most civilized, from the most ancient to the present time, sickness and death, insanity and imbecility, injustice and violence, everywhere appear as if these were the normal conditions of mankind. And even if we penetrate beneath the surface, and study the origin and progress of epidemics and endemics, of the slight causes which produce mental and moral aberrations, and of the universal greed for wealth, we can readily admit the conclusion at which the world has long since arrived, namely, that these physical evils are visitations inflicted as part of the curse of man's first disobedience. In various religious and social phrases we are accustomed to express the historical conviction of the race as to the inherent nature of man's infirmities and prematurity. But the science which we cultivate, and which this Association is organized to promote, discarding the traditions of the past and the teachings of false philosophies, interprets the laws that have been set for the guidance and control of man's earthly existence by the exact demonstrations of a true physiology. This science of life reveals to us the stupendous fact that man is born to health and longevity, that disease is abnormal, and death, except from old age, is accidental, and that both are preventable by human agencies.

In order to fully comprehend the mission of sanitary science, and its capability of benefiting our race, we should, at the outset of our organized efforts, thoroughly understand man's inherent capacity for health and long life, and the conditions which modify or vitiate them. For, if we labor as did our elder brethren in the belief that disease and death are visitations of God for violations of the moral code, our efforts will be vain, diseases will not be prevented, and death will continue to press its claims to two thirds of man's rightful and inherited existence.

In all that pertains to his physical organization, man is a member of the great family of vertebrates. Comparative anatomy and comparative physiology teach the same lesson in regard to his ultimate relations with the animal kingdom. He has the same mode of development, growth, and decay, and in his corporate whole are found the same tissues and organs, governed by the same laws regulating structural waste and repair. Comparative pathology also confirms this view. We are not, therefore, limited in our observations and investigations of the laws regulating animal life to the human subject.

Life manifests itself under so great a variety of conditions and circumstances that we must first define what we are to understand by the term. It is equally present in the seed-corn from an ancient catacomb, and in the most complex living organism. In the first case it is passive or latent, and in the second active or efficient. "There are organisms," says Prof. Owen, "which we can devitalize and revitalize — devive and revive — many times." He adds: "As the dried animalcule manifests no phenomenon suggesting any idea contributing to form the complex one of 'life,' in my mind, I regard it to be as completely lifeless as is the drowned man whose breath and heat have gone, and whose blood has ceased to

circulate." And still, again, we have in the lower orders of animals the young budding out from the parent, and this repetition going on for centuries without the actual assumption of independent existence. So intimately are the lives of the parent and offspring united that it becomes quite impossible to fix the limits of either. "Individualities," says Spencer, "merge and are not distributed in such cases as fusion and fission, which renders the estimation of their longevity a matter of great indefiniteness, and we shall find it most agreeable to all the facts in issue to consider as individuals all those wholly or partially independent organized masses which arise by multicential and multiaxial development that is either continuous or discontinuous." From these and other instances that might be given, it is apparent that in the sense in which we are to study the phenomena of life a restricted definition is required. It is not latent life, nor that state of hibernation in which many plants and animals may be preserved for long periods, and until brought into conditions favorable for a renewal of all their functions. Nor is it the life of organisms in which the life of the parent and offspring are inseparable. It is, on the contrary, efficient life, or the life of the individual having complicated parts, cast off from the parent stock and left to struggle for its own existence. "By life," says Coleridge, "I everywhere mean the true idea of life, or that most general form under which life manifests itself to us, which includes all other forms. This I have stated to be the tendency to individuation; and the degrees or intensities of life to consist in the progressive realizations of this tendency." This definition limits the field of observation of the phenomena of life. We may exclude all organisms which cannot be individualized; whose structure is so homogeneous and whose organs are so few or so simple that they are practically without organs.

Every living organism is endowed with life-force or life-matter, and, whether spoken of as force or matter, is of no consequence; for, as has been well explained by an able writer, force implies matter in a particular condition. Older writers spake of *vires in posse* and *vires in actu*. Modern writers speak of vital force, protoplasm, bioplasm, germinal matter. This fact is conceded by all, that each animal has a given limited supply, which is, in truth, "its stock in trade." During the period of growth this stock, though drawn upon largely, is renewed or increased to a limited extent. But a period is finally reached when this germinal matter ceases to be renewed, and is capable only of maintaining the organism; here growth ceases. From this time forward the vital powers are expended in the maintenance of tissues now fully formed, and it follows that in proportion as this force is husbanded will life be prolonged, and *vice versa*. The question of the length of life must, therefore, be determined by the question of the expenditure of the matter of life.

But physiology gives us a still deeper insight into the complex animal organism. It teaches that the whole is but a collection of cells, or, as has been well said, a "commonwealth of units." Each of these entities has its own specific life to live and death to die. This tissue element has its own quota of vital force. The cell, or entity, performs its allotted function,

passes through the several stages of life, exhausts its own life force, dies of old age, and is borne out of the organism as dead and effete matter. If we could study the activities of the animal system with microscopical vision we should witness in every tissue the constant development of these units, — their growth to adult age, their period of maturity, their decay and final death. The food we eat furnishes the elements necessary to the development, growth, and maintenance of these units, and the excretory organs supply the apparatus for the removal of dead tissues. And though vast multitudes of these entities hourly die and are cast out of the system, yet the commonwealth still lives.

We may next inquire what is longevity? Longevity is defined to be, "the length of time during which life is exhibited in an individual." Observation teaches that this period varies greatly, not only among animals of different species, but also among animals of the same species. Each individual has, therefore, its own special "lease of life," and hence we have "individual longevity." Again, each species has its average length of life, being the average age at which all the individuals live, computed for a number of years. This is specific longevity. In addition to these divisions, some individuals of each group attain to a greater age than the average, — to a remarkable age for the members of this family, — demonstrating the power of the group to reach extreme age. This is called absolute potential longevity.

We have the basis of our estimate of health and longevity, disease and prematurity, in the preceding physiological truths. Health consists in the preservation of the orderly and undisturbed succession of the ultimate elements of tissues through the several stages of their existence, and longevity of the economical distribution and use of the vital forces with which the individual cell elements of the particular animal is endowed. Disease is the disturbance of either the normal development, growth, and maintenance of these ultimate elements of tissues, and premature death is the exhaustion of the vital forces by other than the physiological processes of the body. It is evident, therefore, that the question of longevity is to be determined by estimating correctly vital endowment and vital expenditure.

There are several methods of estimating vital endowment, but one will suffice as a test of man's inherent capacity for long life. It is a recognized fact that organisms having but few and simple parts are feebly endowed with vital force, and are correspondingly short-lived. And a more critical examination shows that we have in the simplicity and complexity of the organism a law by which we may determine comparative longevity. The more simple the organs, the shorter in general is the life, and for the reason that but little force is required in their development and maintenance. Such animals are, therefore, endowed with but little native power. In proportion to the complexity of the organs is the endowment of the animal with force, and in proportion to the force is the inherent power of maintaining life.

But complexity of organism proves increased or higher evolution, and greater individuality. That is, the more numerous and complex are the organs of any given animal, the more is it unlike any inferior animal. It

not only reaches a higher stage of evolution, but becomes distinctly individualized. Hence it follows that high evolution and individuation show an inherent capacity for longevity, or the continuance of life.

If, now, we apply this test to man, we find his capacity for longevity exceeds all other vertebrates. He has the largest number and the most complex arrangement of organs. In him the tendency to individuation is strongest, and the degree of evolution is the highest.

But vital expenditure is a most important element in determining the length of life of the animal. Whatever may be the vital endowment, the vital expenditure may be so great as to render life necessarily brief. For example, the function of reproduction exerts a marked influence upon the capacity for life. In many animals the expenditure of vital power in reproduction is so great that life soon after becomes extinct.

The best single illustration of man's capacity, in comparison with all other animals, to diminish vital expenditure and husband his stock in trade is seen in his ability to supply himself with food. Uncertainty of food, requiring abstinence, or great exertion to obtain it, tends to loss of power, or too great expenditure in securing it. Large families of animals have been extinguished by famine, and the struggle for food among others has resulted in immense sacrifices of life. Average longevity among all animals is low on this account.

Man, on the contrary, being omniverous, can secure his food from many sources. He can sustain vigorous health on the products of the soil, or the river, or the forest. Nor need he expend his strength unavailingly in search of food, for by his ingenuity he can devise means of securing it with but slight effort. But above all other considerations, immense brain development is an endowment greatly increasing his capacity for longevity. By suitable protection and cultivation we may greatly extend the life of any plant or animal, for by such care we may supply more largely and continuously the conditions favorable to life, and diminish the wear and tear incident to the struggle for food. In a similar manner man may and does husband his native resources, and reduce to a minimum the expenditure of his forces. These facts are illustrated in every page of history, and by every day's observation. Consider how he lays the whole earth under contribution for his food supply; the infinite variety of implements by which he secures his food without the expenditure of effort; and the vast ingenuity shown in the methods by which this food is reduced to forms requiring little effort in digestion and assimilation. Consider also by what skillful appliances he continues to repair the wastes and inroads of decay or accident upon his bodily organs and their functions. If his teeth fall out, or are knocked out, he repairs the breach with others quite as useful and perhaps more ornamental; if his leg or arm is lost, another appears instantly in its stead. On all hands he wards off decay and death, and large sections of the human family are devoted to constructing devices to reduce to a minimum the vital expenditure and ill effects of disease and accident.

And there is a still higher and more ennobling view which we may take of man's capacity for diminishing vital expenditure. It is his disposition

to combine with his fellows, and by coöperation, or by a community of effort, increase the power of each to diminish wear and tear. In such communities the greatest good of the greatest number is sought, and the struggle for life becomes very slight. The young and old, and the crippled — all, indeed, who would have met with premature death in animal society, are now cared for, and the average of life is greatly extended.

And it is a well-established fact that the average of human life is gradually lengthened in civilized communities ; that in many European capitals it has extended from thirty-three to forty-five years within a period of two hundred years. Macaulay states that in the year 1665, which was not more unhealthy than other years, one twenty-third of the people of London died, but when he wrote the mortality was reduced to one fortieth annually. Here was a reduction of nearly fifty per cent. in the annual mortality of a single city, within a period of two hundred years. And yet the city of London has immeasurably increased during that time.

The medical profession has been accustomed to point to this increased longevity as proof of its own more successful methods of treating disease. But there are abundant evidences that this increased expectation of life has other and more significant explanations — that it is rather due to man's advance in a higher civilization which enables him to live with less expenditure of vital force, and which leads him to seek his own highest welfare in the common effort to promote the welfare of all.

If, now, we turn from this inquiry as to man's inherent capacity for longevity to inquire as to its limitations, we find that physiology teaches that in every tissue, and in every organ, and in the corporate whole, there is inherent death.

As the physiological units of which the body is composed, each in its own sphere exhausts the force with which it was endowed, and dies, though in contact with, and in the midst of, healthy, living activities, so the body as a whole finally exhausts its inherent and hereditary force, and falls into inevitable decay and final dissolution. The evidences of this diminution of vitality or matter of life, appears differently in different individuals long anterior to its complete exhaustion. Paget, in his "Surgical Pathology," thus describes the period of physical decline : "Some people, as they grow old, seem only to wither and dry up ; sharp-featured, shriveled, and spinous old folks, yet withal wiry and tough, clinging to life, and letting death have them, as it were, by small instalments slowly paid. Such are the 'lean and slippered pantaloons,' and their 'shrunk shanks' declare the pervading atrophy. Others, women more often than men, as old and ill-nourished as these, yet make a far different appearance. With these the first sign of old age is that they grow fat ; and this abides with them till, it may be in a last illness, sharper than old age, they are robbed even of their fat. These, too, when old age sets in, become pursy, short-winded, pot-bellied, pale and flabby ; their skin hangs not in wrinkles but in rolls ; and their voice, instead of rising 'toward childish treble,' becomes gruff and husky."

The question, what is the normal longevity of man — that is, what is

the natural or average normal life of man when he lives out the full measure of his days — is a very important one. If we can determine this point we shall fix a standard by which to estimate the effects of the influences which surround him in any given condition. Observation and tradition have been principally relied on to answer this question. But such evidence is unreliable, and is entitled to but limited credence. It is infinitely more important to seek in the fixed and unvarying facts of anatomy and physiology the natural and hence invariable law governing the existence of each individual species. These sciences give several methods of determining the longevity of animals. Buffon was of the opinion that the period of growth comprised about one sixth of the animal's existence. Growth being completed in man at 16, would prove that his normal length of life was 90 to 100. The period of the complete ossification of the long bones, or the union of the epiphyses with the diaphyses, was adopted by Flourens as the measure of one fifth of the animal's existence. This event in man transpires at about 20, which would fix his normal life at 100 years. Again, the teeth afford strong evidence of the animal's natural term of life, the perfected teeth marking one fourth to one fifth of its existence. These are completed in man at 20 to 25. In the short-lived the crowns are low and the permanent teeth appear early, but in the long-lived the crowns are large and high, and the permanent teeth appear late. In the horse the crowns of the molars are long, and in the ox they are short, and their respective lives correspond. In man two sets appear, with long crowns, and the last set are not completed until about 20. This would give 100 years as man's normal life. Flourens has taken also the procreative period, and concludes that in man maturity occurs at 30, and that this marks one third of life. The result of these various anatomical and physiological methods of determining human longevity, all agree in giving 90 to 100 years as the normal period. And this estimate is confirmed by observation and tradition.

We are justified, therefore, in fixing the normal period of man's earthly existence at about 100 years. This is the limitation of life fixed by the laws governing his development, growth, maintenance, and decay. This is the length of life to which every man has an inherent right. Every death at an age short of that period is due to unnatural or abnormal conditions. For, whatever peculiarities man may inherit from his ancestors which curtail this period, his normal development is still according to the type which gives him 100 years of life. This, therefore, is the standard of average normal longevity which we must set as the lease of life inherited by man.

But if normal longevity is thus established, what does science teach as to absolute potential longevity? That is, to what period may exceptional lives extend. May not individuals be endowed with matter of life so largely, and have so slight expenditure, that life may be extended far beyond the limits now fixed? In other words, is 100 years the extreme limit of human life, or can we accept the traditional belief that life may, under favoring conditions, be extended to variable periods much beyond 100 years?

If there was any period of human history when all the conditions favored extreme longevity it was that post-diluvian era — the patriarchal age. Man then seems to have lived more nearly according to the dictates of instinct; in other words, he led a natural life. He roamed about under a genial sky tending his flocks. His exercise was moderate; his nervous system was never overtaxed; his food was simple; his house a tent; his home the uplands of Judea. His mode of life secured moderate activity to the muscular and circulatory system, repose to the nervous system, simple and nourishing food, healthy digestion, and exemption from the local causes of disease. The historian tells us of no other cause of death during that period than accidents and old age. And what charming pictures of pastoral life and serene old age are given us in the histories of the patriarchs; what vigor of body at great age, and what repose and serenity of mind. At the age of 75 Abraham migrated with his family and flocks; at 100 Isaac was born, Sarah being 90; at upwards of 120 he bore with heroic firmness the trial of his faith. Isaac led a peaceful uneventful shepherd's life, and reached the age of one hundred and fourscore years. Jacob's life was more or less disturbed by anxiety, even to its close, but it was extended to 147 years.

Professor Owen regards these evidences of great longevity as entirely unreliable. Such great age in the human subject, he remarks, is only a theological possibility, unless man in that age was structurally as regards size, height, and tissue very different from the present. But such human bones as have been discovered, dating nearly to this period, are analagous to those of the present. If man lived to the reputed age of some antediluvians, gestation would occupy eight years and maturity would be attained at 180 years. However these extraordinary traditions are to be explained, the proof that man's present lease of life is 100 years, and that in the most extreme cases it does not exceed 110, or at the utmost 115 years, seems incontestable. Anatomy and physiology give us a basis of estimation which all our collected facts and observations are tending more and more strongly to confirm. We must abandon old Parr, and the host of modern physical and moral monstrosities, and reckon them among examples of human credulity. Without pausing to consider further the arguments now brought forward to establish the normal and potential longevity of the human race, we may state it as a truth, accepted by scientific men, that man has a normal life of 90 to 100 years, and that by reason of strength he may reach 110.

Viewed, then, from the stand-point of comparative anatomy and physiology, man is the acknowledged head of organic nature. By whatever means he may have attained this elevation — whether by creation or evolution — his rightful superiority is attested by conditions inherent in his constitution. His tendency to individuation so far exceeds that of his inferiors as to separate him physically widely from the highest animal development. And if to his physical, we add his intellectual superiority, how sublime, how transcendant appears the earthly destiny of man! By his excess of brain power alone he not only subdues all forms of animal

life, but makes them contribute as he wills to his welfare, and in ten thousand ways minister to his comfort and happiness. When we thus for a moment contemplate man's enormous capacity to subsidize all available matter to his own use, how the finite encroaches upon the infinite, how rational is the belief, that man was made but little lower than the angels of heaven!

Let us now turn from this study of man's inherent capacity for longevity, and examine the obverse of this picture. What is man's actual longevity in the United States, where he controls all the elements which conspire to lengthen life? We note in the first place the total mortality of the entire population in 1870 was 492,263. Of these, 110,445 died under one year of age. That is, somewhat less than one fourth of all who died had not seen their first birthday. 203,213 died under five years, being a little less than one half of the total mortality. In the light of the preceding discussion, how humiliating is the revelation that, taking this country as a whole, nearly half its mortality falls upon children under five years of age! It will surprise no one to learn that if over 41 per cent. of the deaths in this country are children under 5 years of age, not far from 60 per cent. of the deaths are of persons under 25 years of age. 60 in every 100 persons dying in this country have scarcely attained to maturity — have lived but about one fourth of their allotted time. From the age of 25 and upward the numbers rapidly diminish at every quinquennial count. Of the half million deaths, about 16,000 reached 45–50, 13,000 reached 55–60, 14,000 reached 65–70, 11,000 reached 75–80, 4,500 reached 85–90, 1,300 reached 95 and upwards. Of the total number, 17,429 reached 80 years and upwards, or 3.5 in every 100; and 1,300 passed 95, or about 3 in 1,000.

If this were the first time our attention were called to the immense discrepancy between the normal and actual life-time of man, we should inquire, How is it, that in a race of beings having such power over its own destiny, and striving by every means to obtain long life, but three in every one thousand dying reach their preordained longevity! How is it, indeed, that nearly half of those dying have not passed their fifth birthday — have not, in fact, lived as long as most of the short-lived animals which we contemptuously crush under our feet? Difficult as the problem would seem to be, the most ignorant person in any community in this country can give the key to its solution. Within the limits of his own observation he sees innumerable causes and conditions abridging life; within his own household he sees death remorsely claim its victims, and he takes accurate note of the cause. Nay, in his own body he witnesses the manifold causes of sickness and death waging a perpetual warfare with his vital forces.

But if we would see at a glance the formidable array of agencies fatal to man's health and longevity, we should turn to the page of the census returns where is recorded the diseases which caused this immense mortality. Here is a partial list: Of general diseases there were 32; of nervous diseases, 13; of the circulatory organs, 6; of the respiratory organs, 8; of the digestive system, 25; of the genito-urinary organs, 12; of the limbs, 4; of the skin, 3; of injuries, 24. And this list comprises only those general expressions applied to diseases which in multiplied and complicated forms

assail man on every hand. Each disease can assume various phases, and is indeed susceptible of assuming innumerable forms and methods of attack. Contemplating this vast army of diseases fatal to man, we are no longer surprised at the uncertainty of his life. Indeed, we may rather be surprised that man's average longevity is as great as it is. Every point in his system seems to be vulnerable; every tissue and every organ are liable to destruction by a multitude of maladies; the earth and air teem with the germs of disease; the food he eats and the water he drinks may conceal the poison which destroys his life; legions of fatal influences encompass his pathway and lie in wait for him at every step of his earthly pilgrimage. A more dark and gloomy picture could scarcely be drawn than that which the human race presents on the charts which illustrate its mortality. Born to great longevity, with immense intellectual superiority, man appears inferior to the meanest and lowest creature in his capacity to care for himself.

The question which occurs to every mind is, must these things need be? Is this enormous waste of human life necessary? The answer of the ages past has been affirmative. Disease has been regarded by civilized and savage nations as the expression of the Almighty's disapprobation of man's moral conduct; and civilized and savage peoples alike have sought to propitiate the offended Deity by religious rites and ceremonies. No rational efforts were put forth to detect the cause, much less to remove it.

It is scarcely more than a decade of years since the people of England proposed to meet a wide invasion of cholera by fasts and prayers. But the Prime Minister, instead of appointing the required day, answered his petitioners by requesting the people first to take energetic measures to destroy all kinds of filth, and render their homes clean, and then ask the Almighty to bless their efforts. The proclamation of these great truths by that eminent statesman inaugurated the era of sanitary reform. A new science now dawned upon the physical destiny of man, whose rays penetrated the darkest recesses and revealed the hidden forces which with such irresistible energy had hitherto devastated the race. It revealed also the stupendous fact that disease is an anomaly; that it is largely, and perhaps always, caused by agencies which man can remove or destroy. Nay, more, it demonstrated that the most destructive diseases are generally of man's own direct creation, and entirely subject to his will.

And this leads us to the consideration of those practical questions which, as sanitarians, we should thoroughly study, and fully comprehend, namely: First, how far can human agencies modify longevity; and, second, what measures are best adapted to render the application of those agencies most effective?

The art of prolonging life has been the earnest study of mankind in all ages of the world. They have sought the "elixir of life" in astrology, in chemistry, and by the most elaborate systems of investigation. It has been the *ignis fatuus* which speculative philosophers have pursued with unabated interest from the earliest records of history. Others have sought, by recording the habits of the long lived, their diet, etc., to determine the true method of prolonging life. And it is interesting to notice how contra-

dictory are these methods as developed in different individuals. One has led a quiet, while another has led an unquiet life; one has never tasted ardent spirits, while another has drunk freely; one is abstemious, another a glutton; one is chaste, another is unchaste; one is rich, another poor; one is cleanly, another uncleanly.

Turning from the idle speculations of the past, let us inquire what modern science teaches as to the power which man may exercise over his own longevity.

In the first place, let us note the general conditions which shorten life. Of these the most important is excessive expenditure of vital force. This expenditure may occur in various ways. In infants and the young, if the food is improper, or the clothing too scant to secure warmth, renewal does not take place at an age when the expenditure for growth and maintenance is greatest, and exhaustion rapidly follows. At maturity the passions ripen into activity and have their full play, and if not suitably controlled afford large and exhaustive expenditure of vital power. In the decline of life there are losses of many agencies necessary to sound health. Again, vital expenditure may be very great from other causes, as among the poor and destitute, in whom the life force is often early exhausted in the struggle for food, and from sheer want of proper means of renewal. It may occur also in the opposite extreme of society, where we witness immense vital expenditure in the struggle for the luxuries of life, for wealth, position, and power. Here, owing to the wear and tear from anxiety, loss of sleep, and the concomitants, defective digestion and assimilation, waste exceeds supply, and exhaustion exceeds renewal. And to these general causes of waste we should add impure air of dwellings, improperly prepared foods, inebriety, gluttony, and ten thousand nameless sources of constant impairment of the vital functions without the power of suitable renewal, which fill up the measure of man's daily life in modern society. Over nearly all of these conditions man may exert the most arbitrary control. He can feed and clothe the young, the old, and the helpless; he can moderate his passion to a healthful play; he can so regulate his habits as to secure a uniform expenditure and a maximum of renewal of vital energy; in his food, in his drink, in his home, and at business, he is master of everything that affects his well-being.

Admitting, in his organized social capacity, that in all these respects man literally controls his own destiny, how does he stand related to those other potent causes which so impair, damage, or destroy life, classified under the general head of diseases? Can he prevent the fevers and inflammations which consume his stock of life-matter with such remorseless energy, or the manifold maladies which attack and destroy any and every organ and tissue? Nay, more, can he cope with those devastating plagues which fall upon communities like sudden storms, and, leaving wide devastation in their path, as suddenly disappear?

We are in a position to-day to answer these questions in the affirmative. Man has but little less power to protect himself from the diseases which afflict him than he has to control his own habits. Every disease

has its special cause or condition, and these causes and conditions are in the vast majority of cases susceptible of removal, destruction, or avoidance. If we examine in detail the diseases recorded in the census returns with a view to separate the acknowledged preventable diseases from the inevitable, the avoidable from the unavoidable, we can but be surprised at the meagreness of the latter list as compared with the former. And under the searching scrutiny of modern physiology, pathology, and chemistry the number of preventable diseases is daily increasing, while the inevitable are steadily declining. The researches of Hallier, Pettenköfer, Burdon-Sanderson, Thudichum, and others are rapidly extending the bounds of our knowledge of the intimate nature of the causes of diseases, and teaching us the methods of removing them, or of rendering them harmless.

We are not then claiming too much for sanitary science when we say that man to-day possesses the power and the knowledge, under the guiding hand of Providence, to lengthen or shorten at will his earthly existence. He may expose his offspring, as he generally does, to cold, to hunger, to foul air and improper food, and to avoidable diseases, and see one half swept off during the first years of their existence. He may yield to all his hereditary and acquired passions and appetites, and perish at maturity, or reach a decrepid old age at thirty. Or, on the contrary, he may protect the humblest infant and so nourish it as to rear it to manhood; he may so order his life as to fully and healthfully develop his passions and appetites; he may sustain the wasted energies of the aged and feeble so as to make their days long in the land, and by these means extend the period of longevity, unless accident cuts short his existence, to that age ordained in his constitution.

It may be asked, How is it that with all this power and with all this knowledge, man, in this enlightened age, and in this country, so adapted to the full enjoyment of personal control — in other words, to high individuation — fails so lamentably to realize the fruits which such power and such knowledge surely promise? We answer, ignorance. The people at large do not know, much less realize, the extent to which they may control their own longevity. Even the higher circles of society are ignorant of the nature, whether for good or evil, of the air they breathe, the food they eat, the water they drink, the clothes they wear. Nay, more, the medical profession is so devoted to the care of the sick, that it does not study as it ought the methods of preventing sickness. Where all ranks of society, and even the learned professions, are thus ignorant of, or at least indifferent to that species of knowledge which protects and defends life, the state must necessarily be even more ignorant and indifferent.

And this leads to the question which most immediately concerns us, namely: How may sanitary knowledge be made available and be applied with the greatest effect? The subject has manifold aspects, and will engage the attention of this and similar organizations as long as man dies from other causes than old age. I shall briefly allude to some of the more important methods which are suggested.

1. *The education of the people.*

The general facts of physiology and pathology, the basis of preventive medicine, should be taught in all our schools. And to render such teaching effective, books should be prepared on these subjects adapted to every grade of scholarship, from the infant class of the primary school to the senior class of the literary colleges. These studies are not too abstruse for the young. They can be made more interesting by one competent to teach than any other branch. Whoever has amused himself with anatomical and physiological narrations to very young children, aided by drawings, has been surprised at the interest excited, and the lasting impressions produced. The anatomy of the human hand and foot, explained by means of the articulated specimen, will instruct a child of average intellect before it has learned its letters. The child of ten years can comprehend the acts of digestion and assimilation, the structure of the lungs and the method of respiration, the anatomy of the heart, and the nature of the circulation, etc. A pupil of fifteen can understand the composition of foods, of the air and of water, in their relation to the wants of the system. The higher grade of scholars can become thoroughly familiar, when thus advanced, with the causation of ordinary diseases, that is, how the nature of the soils, the impurities of the air, water, and foods, the structure of the house, the peculiarity of business, etc., etc., may affect the health. It only requires properly prepared and illustrated text-books and competent teachers to make the work of instruction in these branches practicable and efficient in every department of our public and private schools. Then we should have children answering questions in anatomy, physiology, and pathology, with as much readiness and as understandingly as they now recite their lessons in arithmetic and geography. Were a well digested system of education in matters which so vitally concern the well-being of every person adopted, and put in practice with anything like the vigor with which we insist upon the study of the common and useful branches, like geography, arithmetic, and grammar, and the uncommon or ornamental branches, as French, music, etc., within one generation the whole mass of the people would be so enlightened on subjects relating to the hygiene of every-day life, that our average longevity would be immeasurably increased. For in proportion as we can lengthen the lives of the masses of the people in any period of life, as between one and five years, in that proportion we add to the longevity of the race. And who doubts that at the lowest estimate one in ten of the children now dying throughout the United States under five years of age might be reared if placed under proper care and protection? And what is true of that period is true of all other periods in the normal life of man.

2. *The thorough education of the medical profession in sanitary science, and the reduction of that science to daily practice.*

The medical profession is the proper conservator of the health of the people. Its members are devoted as a life's work to the study of the nature, causes, and remedies of diseases. Whatever advance has been made in our knowledge of disease, either in its prevention or cure, has

been made by this profession. And although medical men have always been sanitary reformers, yet the customs of society have sadly misplaced their duties. In practice, the physician is called to cure disease, and to this feature of his every-day duties he devotes all his thoughts. He waits until the cause has begun to operate before he begins to apply his knowledge. His efforts are now directed, first, to save life; and, second, to prevent damage to the system. Great as has been the advance in our knowledge of therapeutics, it is but fair to say that in both efforts he is very liable to fail. One fact in nearly every case of sickness known is always apparent to the physician, and that is, that at one period the disease might have been prevented, and he recognizes how infinitely more important his advice was at that time. Then disease could have been prevented. Now it cannot perhaps even be controlled. The conclusion seems inevitable, in whatever light we may view the subject, that the physician's duties are sadly misplaced. He should have such relations to the families which he attends that his advice is constantly sought in methods of prevention, as well as in methods of cure. If this were the case, and the medical profession was as much devoted to the practice of the art of preventing as it is in curing disease, there can be no doubt that many diseases which now decimate communities would disappear altogether, and the larger number would have the mortality set opposite them greatly reduced. Thus our normal longevity could again be largely extended. In order to this important reform the medical schools must incorporate Sanitary Science in their course of study, and confer degrees for proficiency in these studies, while the custom of society must be so changed that the physician is employed to prevent rather than to cure diseases.

3. *The professions of architecture, engineering, and allied departments of business must be educated in Sanitary Science.*

Whoever has been brought much in contact with these professions in endeavoring to execute sanitary work has been impressed with the want of information, by even its representative members, as to the principles of that science. How rarely is a building constructed with reference to the health and comfort of those who are to occupy it! Everything is made to conform to some unique style, whether the building is for a residence, a church, a hospital, or a bank. It must be Grecian, Roman, Gothic, Renaissance, or nothing at all. We can never have healthy homes or public buildings until a new race of architects and engineers are educated in the principles of modern sanitary architecture, and all forms and styles are made to conform to those principles.

4. *The State must perform an important part in the application of Sanitary Knowledge.*

However we may educate the people in the art of healthy living; however carefully the medical profession may protect the family and individuals from the approaches of disease; and however intelligently architecture, engineering, and other departments of labor may plan and execute sanitary works; there is still required a central authority which must enforce those needful regulations which require private interest to

yield to the demands of the public welfare. Hence arises the necessity of municipal and State organizations, constituted to exercise supreme jurisdiction in sanitary administration. These bodies should not only be exponents of the present state of sanitary knowledge, but should also constitute an advance corps of explorers in new fields.

The State must differ widely from the municipal organization in the administration of health laws. The former includes within the scope of its inquiry and jurisdiction the entire State. In general its duties are made largely advisory; indeed, far too much so in districts where no health authority exists. The State Boards should have power, under proper limitations, to compel the execution of sanitary works in towns where they are neglected. Nay, more, State Boards should require of all new towns that the foundations be laid with reference to the public health of their future inhabitants, that proper drainage should be made and pure water supplied, etc., before the site selected is occupied. How greatly would the health of the people of these towns be promoted and the term of life extended if the site were selected and prepared by skilled sanitarians?

Municipal Boards have their jurisdiction limited to populations aggregated upon small areas. It is their mission to remove or destroy the sources of unhealthfulness which follow such aggregations, and the concentration of trades and forms of business. And to effect these great purposes their powers should be large and well defined. The privileges of the individual should be rigorously subordinated to the welfare of the community. Private rights should not be allowed to create or maintain public wrongs.

5. *Finally, the General Government should within its appropriate sphere coöperate with State Governments.*

It is an axiom of enlightened statesmanship, that the great want of any country is, and ever will be, a healthy, robust, long-lived yeomanry. Public health means something far more important than public wealth; it means also public honesty and public morality. It is a fact established by the records of our prisons that premeditated crime is rarely perpetrated by those having good habits and sound health. The criminals are the drinkers, the smokers, the licentious, the gluttons; in a word, the morbid. In no way, therefore, can our Government better promote the permanent interests of the people, and "provide for the general welfare," than by diffusing sanitary knowledge.

Again, epidemics like cholera, yellow fever, small-pox, and many others are national in their character and effects, and are always subjects of national concern. They invade the country like a common enemy, prostrate commerce and business, and produce wide-spread distress, sickness, and death. No single municipality and no single State can prevent the invasion; they may protect the communities within their own jurisdiction, but other communities less vigilantly governed must suffer, unless the whole country is united in common measures of defense and protection.

It must be apparent to every one at all conversant with sanitary science and sanitary administration, that the General Government has an impor-

tant duty yet to perform in providing for the general welfare. It must organize on a proper basis a department, devoted to the collection of information in regard to the diseases peculiar to localities and their local causes, of the progress. course, and prevalence of contagious diseases and epidemics abroad and at home, and the diffusion of such information among health authorities in all parts of the country, and among the people at large. It should furnish accurate information to any citizen as to the disease peculiar to any locality in the United States to which he was about to remove; it should secure, as in England, by its advice, the coöperation of all the health authorities of the country in the adoption and execution of measures of protection against approaching or prevailing epidemics; and finally, by its daily information of the location and progress of pestilential diseases, it should forewarn communities which lie in their course, and enable them to make timely preparation against the invasion of these scourges. They have as fixed laws governing their course and progress as the storms, and a central department, as accurately informed of the daily progress of such epidemics as the Signal Service Bureau is of the course and progress of storms, could, with quite as much accuracy foretell their appearance at a given locality. The late epizootic among horses, which illustrates well the course of epidemics, spread over the country by easy but definite stages, like a wide-reaching storm. In its progress it was governed by a law peculiar to that class of epidemics, and which could be determined by means of as accurate observation as are employed in determining meteorological phenomena.

A Central Department at Washington, in communication with all parts of the world and of our own country, discerning the first movements of the common foe, whether in India or along our southern border, could thus display its "danger signals" of approaching pestilences, and by enabling communities to make suitable preparation, could arrest the progress of the hordes of roving epidemics which decimate our cities and villages. For there is no longer any more doubt of our ability to cope with foreign pestilences than with the armies of the countries from which they come if the entire country is organized in the execution of common measures of defense.

It is possible that we have not reached that period of general intelligence in which the health of a community, or State, or nation is to be regarded of as much importance as the crops raised, or even of the degree of education of the people. But there is no doubt that we are rapidly approaching such a period. England has happily already attained to it, and not only has her Central Department of Public Health, in connection with the Privy Council, but the question of organizing a Ministry of Public Health is being agitated, with the prospect of its being speedily established. Prussia, also under the enlightened administration of Bismarck, is organizing a Central Bureau of Public Health, which is to be devoted to the collection of information relating to the epidemics and endemics of the country, and to the diffusion of information on public hygiene among the people.

These are but a few of the many methods by which sanitary science can be applied and made to accomplish its beneficent mission. And who can doubt that if faithfully applied in these various methods, and especially in this country, where the conditions under which communities live can be rendered so favorable to health and longevity, that the average age of the people might be greatly extended?

The outlook, from our present standpoint, of the future of sanitary reform in this country is exceedingly favorable. An agitation has evidently begun which is daily taking on larger and yet larger dimensions. State and municipal boards of health are being rapidly organized in all parts of the country; the medical profession is beginning to manifest a deep interest in sanitary science as a department of study, and medical societies in all the States are earnestly discussing the various questions relating to its practical application.

In the midst of these active agencies this organization is about to take its place. Largely composed of persons actively engaged in sanitary study and administration, the Association must aid powerfully in advancing this reform, in harmonizing measures susceptible of general application, and in securing that coöperation among all our health authorities, so essential to the successful resistance of invading epidemics, as well as the control or destruction of those agencies on which depends the origin or propagation of our domestic pestilences.

THE RELATIONS OF RACE AND NATIONALITY TO MORTALITY IN THE UNITED STATES.

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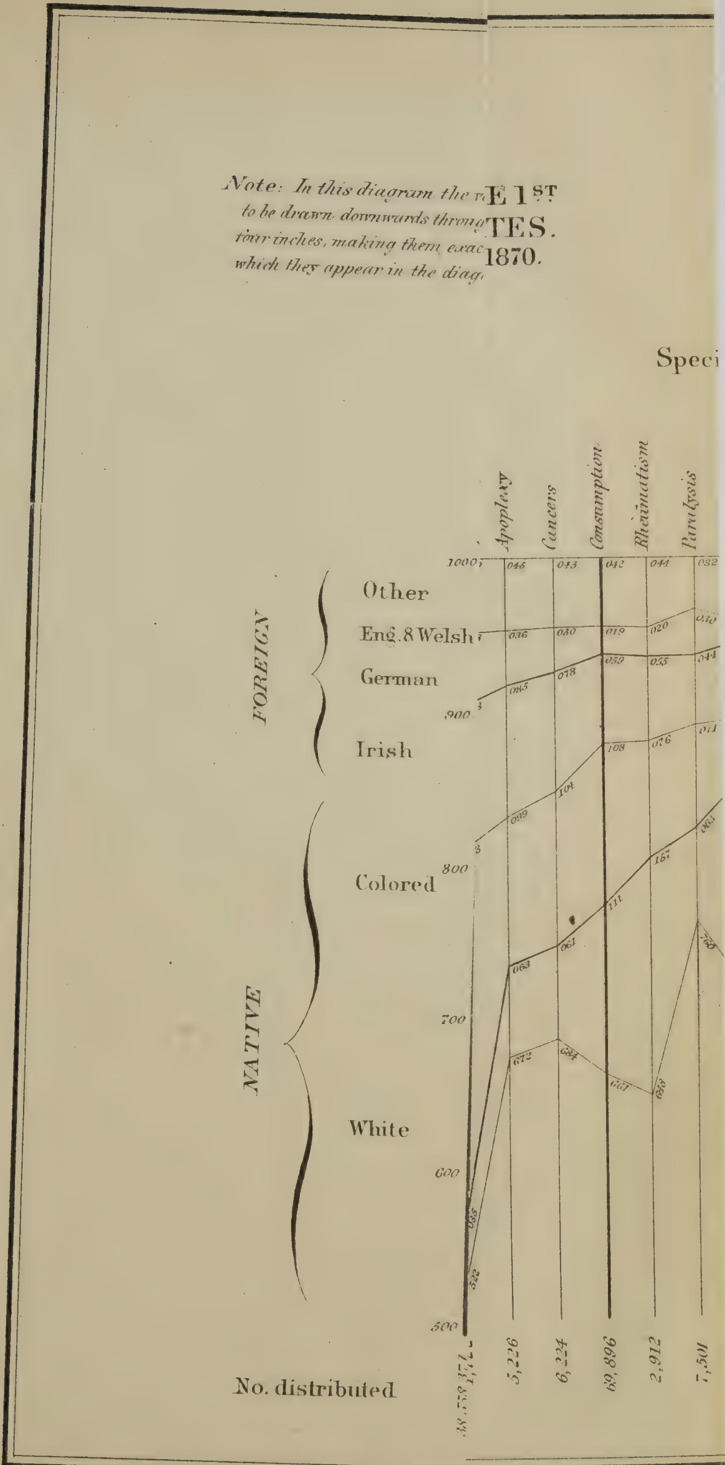
THE census of the United States under the Act of 1850 is overloaded with statistical inquiries which do not necessarily, and some of which do not legitimately, pertain to a census. Among these are minute inquiries respecting agricultural and manufacturing productions, wages, wealth, taxation, and public indebtedness, libraries, schools, periodicals, illiteracy, pauperism, and crime. The reason for so extensively enlarging the scope of the census is found in the supposed lack of constitutional competence in Congress to institute inquiries of any nature, for statistical purposes, except as the same may be connected with the enumeration of the people authorized by the Constitution for the decennial distribution of representative power in Congress and in the Electoral College. It is certainly not for statisticians to closely scrutinize the right of Congress to thus extend the constitutional provision for a census. The subjects of inquiry are in general such as every government should have the right to propose for the proper direction of its legislation and administration of law. But while the objects sought by the Act of 1850 may all be said to be in the interest of science and good government, no one can carefully have studied any census of the United States taken under that law, without learning that the results are, from the varying difficulties of the subject matter, and from the greater inadequacy of the agencies employed in some cases than in others, of very unequal value.

The failure of the census to reach the object proposed is, perhaps, nowhere so conspicuous as in the returns of the DEATHS occurring during the census year. The reasons for this comparative failure are not obscure or remote. Statistics of mortality can only be satisfactorily obtained as the result of a system of registration maintained without interruption and rigidly enforced by penalties. In the census of the United States, on the contrary, it is sought by an occasional enumeration to recover information of all the deaths which have occurred during the twelve months preceding. It is not wholly a matter of blame to the agents of the census that such an effort results in the return of but 60, 65, or 70 per cent. of the deaths which we know must have occurred during the period covered by the inquiry.

To take the recent census as an example, the law required the return of all deaths occurring in families, from the 1st of June, 1869, to the 31st of May, 1870, in all, twelve months. The enumeration, in the course of which this was to be accomplished, began on the 1st of June, 1870, and

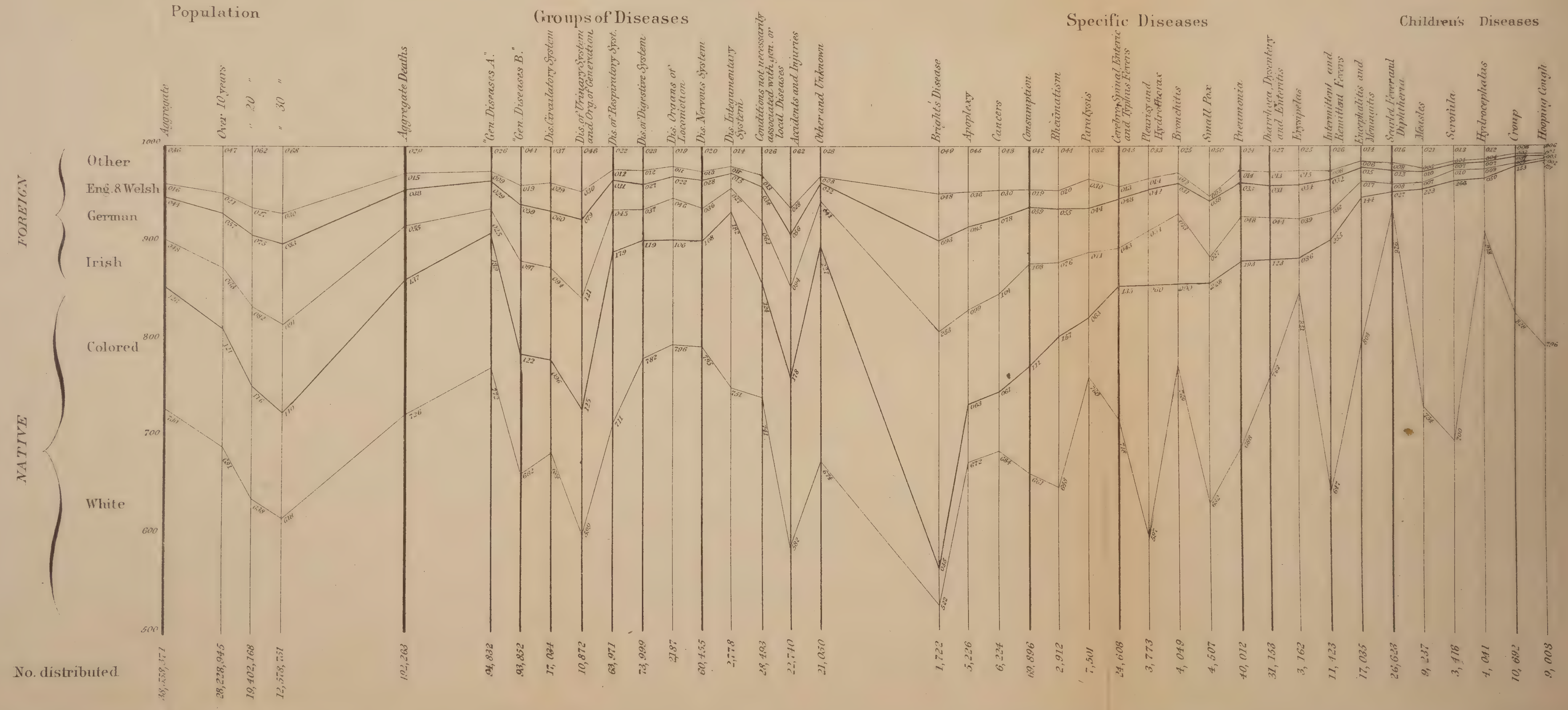


Note: In this diagram the
to be drawn downwards throug
four inches, making them exac
which they appear in the diag
E 1ST
TES.
1870.
Speci
Apoplexy
Cancers
Consumption
Rheumatism
Paralysis
FOREIGN
Other
Eng. & Welsh
German
Irish
NATIVE
Colored
White
1000
900
800
700
600
500
No. distributed
5,226
6,224
69,896
2,912
7,501

CHART
SHOWING THE DISTRIBUTION
OF THE
DEATHS
OCCURRING DURING THE CENSUS YEAR ENDING JUNE 1ST
BY RACE AND NATIONALITY, FOR THE UNITED STATES.
compiled from the Returns of Mortality at the Ninth Census U. S. 1870.
BY
FRANCIS A. WALKER.

Note: In this diagram the vertical lines are supposed to be drawn downwards through a further distance of four inches, making them exactly twice the length at which they appear in the diagram as engraved.

The division of the total foreign over 10, over 20, and over 30 years of age, severally, into the specific nationalities represented in the diagram, has been effected by estimate.



closed nominally on the 1st of October, 1870, but really on the 1st of January, 1871. Thus the officers of the census were called upon to recover all the deaths occurring during the census year at distances in time ranging from one day to nineteen months from the dates at which such deaths severally occurred. The antecedent improbability of success in such an attempt would be of the strongest. In some cases, assistant marshals would fail to put the question; in others heads of families, or persons answering for them, would, in the abruptness of a hurried enumeration, fail to recall the fact of a death occurring during the year, especially when many months had already elapsed since the date of death. In still another large number of cases persons would have died *out of families*, which class of cases seems not to have been in contemplation of the census law, which makes the return of mortality a family return. In still other cases, deaths would have occurred in families, the death itself, however, breaking up the family and scattering the surviving members, leaving no one to report the death in the census. In still other cases, deaths would have occurred in what were constructively families for the purposes of the census, *i. e.*, boarding-houses, hotels, etc.; but the common tie of membership or of association would be here so casual and so slight as to put the chances altogether against the circumstance being retained in memory six, eight, or twelve months after.

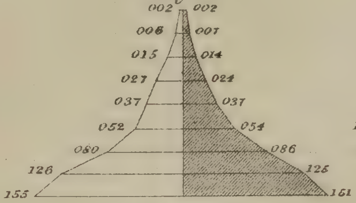
What, then, it may be asked, can be the value of statistics confessedly so imperfect? Can any deductions be made with confidence from returns of mortality, which omit one third or more of the deaths which occurred within the period which the returns profess to cover? We shall attempt to answer this question only so far as relates to the immediate subject of our present discussion, the Relations of Race and Nationality to Mortality in the United States.

Can we then assume that the omissions acknowledged are, if the expression may be used, so uniformly distributed in these respects, as to allow conclusions to be founded with assurance upon the relations which are disclosed by the body of deaths actually reported in the census?

The several elements of our population, with respect to race and nationality, are not so placed that we can assume that error is quite as likely to occur in the enumeration of one as of another, and consequently that, in covering so large a field, errors may be relied upon to balance each other, leaving a result of substantial accuracy. On the contrary, the tendency to omission in the enumeration of deaths varies with the intelligence of the several communities, the density of settlement, the prevailing occupations of the people, and the habits of life, so far as these affect the permanence of residence. It is notorious that the several elements of our population are, the country over, variously placed with reference to these conditions. Hence we may not assume an equal liability to omission in all. Undoubtedly, some of the elements we are to consider are more concerned in the defects of the census law than others; and these differences I believe to be sufficiently great to invalidate conclusions based on anything like a nice determination of preponderance in the census statistics of mortality.

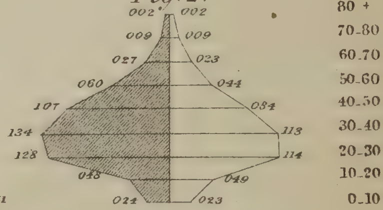
POPULATION BY AGE AND SEX.

Fig. 1.



Native

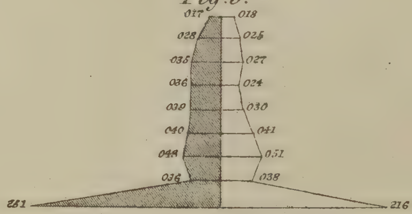
Fig. 2.



Foreign

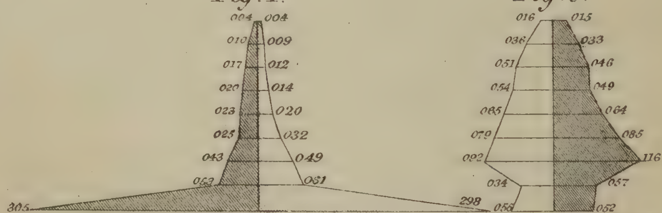
DEATHS BY AGE AND SEX.

Fig. 3.



All Diseases

Fig. 4. *Fig. 5.*

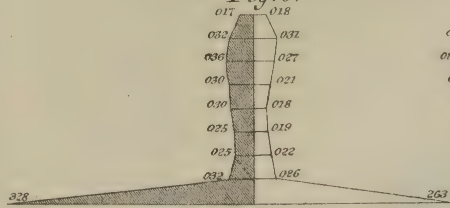


"General Diseases A". (Febrile) "Gen. Dis. B". (Constitutional)

The total number of deaths is reduced to thousandths, and the number of thousandths of each sex, in each decade of life, is represented by the distance measured on the horizontal lines, severally, from the perpendicular. Males on the left, females on the right. The sex which preponderates is shaded.

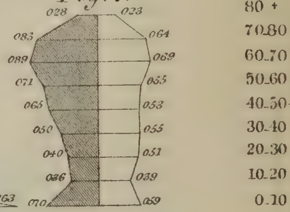
DEATHS BY AGE AND SEX.

Fig. 6.



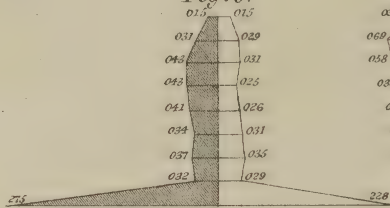
Dis. of Nervous System

Fig. 7.



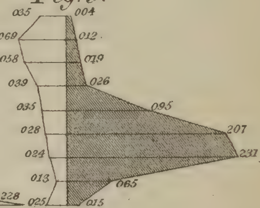
Dis. of Circulatory System

Fig. 8.



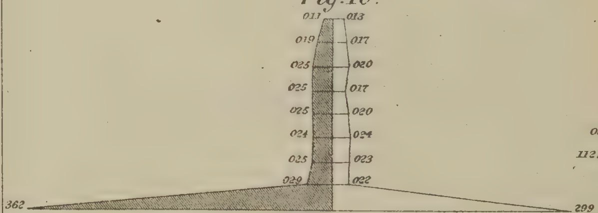
Dis. of Respiratory System

Fig. 9.



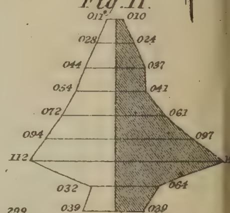
Dis. of Urinary System and Organs of Generation including affections connected with pregnancy

Fig. 10.



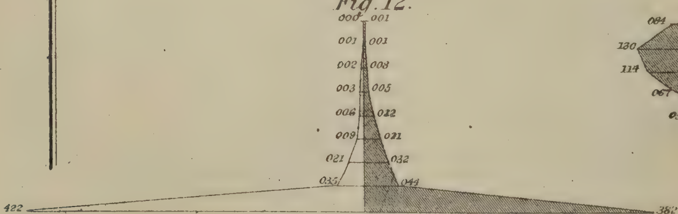
Diarrhoea, Dysentery and Enteritis

Fig. 11.



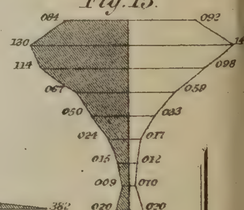
Consumption

Fig. 12.



Measles

Fig. 13.



Paralysis

The total number of deaths is reduced to thousandths, and the number of thousandths of each sex, in each decade of life, is represented by the distance measured on the horizontal lines, severally, from the perpendicular. Males on the left, females on the right. The sex which preponderates is shaded.

Diagram No. 1, exhibits to the eye the proportions above expressed, with others which are deemed essential or advantageous for the discussion of the relations of race and nationality to mortality in the United States.

The first four vertical lines, counting from the left, relate to the number of living inhabitants on the 1st of June, 1870, the first representing the aggregate population; the second, third, and fourth, the population, respectively, above ten, above twenty, and above thirty years of age. The fifth line (standing by itself) represents the aggregate body of deaths reported as occurring during the census year as above. The group of twelve lines next succeeding represent the body of deaths occurring within each important group of diseases. The group of twenty-one lines which complete the diagram represent the body of deaths occurring within each of the enumerated specific diseases or subordinate groups of diseases. The thirty-eight vertical lines described are crossed by lines which show the division of each of the thirty-eight subjects represented among the larger elements of the population which have been taken for our present consideration. The scale of the diagram will not allow the lines representing the Swedes, Norwegians, and Danes, the Scotch and the French to be laid down. These proportions are also, for further convenience of comparison, expressed in parts of 1,000 in the following table, in which the nationalities omitted from the diagram appear: —

TABLE I. — A.

Groups of Diseases.	Aggregate.	Native White.	Native Colored.	Total Native.	Total Foreign	Irish.	Germans.	English and Welsh.	Swedes, Norwegians, and Danes.	Scotch.	French.
All Diseases	1000	726	137	863	134	55	38	15	5	4	3
General Diseases — A . . .	1000	772	139	911	87	25	29	9	7	2	2
General Diseases — B . . .	1000	662	122	784	214	97	59	19	5	6	5
Diseases of the Circulatory System	1000	684	96	780	217	94	60	29	4	6	6
Dis. Urinary System and Organs of Generation . . .	1000	599	125	724	274	121	79	30	6	7	6
Dis. Respiratory System . .	1000	711	179	890	109	45	31	12	3	3	3
Dis. Digestive System . . .	1000	782	119	901	97	37	27	12	5	3	3
Dis. Organs of Locomotion .	1000	796	106	902	95	46	22	11	3	4	3
Dis. Nervous System . . .	1000	795	108	903	95	36	28	13	2	3	3
Dis. Integumentary System .	1000	751	182	933	66	27	15	11	1	2	1
Conditions not necessarily associated with general or local diseases	1000	741	124	865	130	63	34	13	2	4	3
Accidents and Injuries . . .	1000	582	178	760	222	94	56	28	7	5	5
Other and Unknown . . .	1000	674	227	901	89	41	22	8	3	2	2

TABLE I. — B.

Specific Diseases.	Aggregate.	Native White.	Native Colored.	Total Native.	Total Foreign.	Irish.	Germans.	English and Welsh.	Swedes, Norwegians, and Danes.	Scotch.	French.
Bright's Disease	1000	522	35	557	438	253	93	48	6	12	3
Apoplexy	1000	672	63	735	259	99	85	36	3	7	9
Cancers	1000	684	61	745	253	104	78	30	3	10	10
Consumption	1000	661	111	772	226	108	59	19	6	5	22
Rheumatism	1000	648	157	805	193	76	55	20	8	6	7
Paralysis	1000	760	63	823	173	71	44	30	2	7	5
Cerebro-Spinal, Enteric, and Typhus Fevers	1000	718	135	853	144	43	48	13	13	3	3
Pleurisy and Hydrothorax . .	1000	597	260	857	142	54	42	14	3	5	6
Bronchitis	1000	769	90	859	137	73	31	12	2	3	4
Small Pox	1000	632	228	860	131	27	58	5	3	*	3
Pneumonia	1000	688	193	881	117	48	33	14	3	3	3
Diarrhœa, Dysentery, and Enteritis	1000	762	123	885	113	44	31	13	7	3	3
Erysipelas	1000	851	36	887	109	39	34	15	3	5	3
Intermittent and Remittent Fevers	1000	647	255	902	96	32	32	8	3	2	4
Encephalitis and Meningitis .	1000	804	144	948	51	17	15	6	2	2	1
Scarlet Fever and Diphtheria	1000	928	27	955	44	8	13	8	3	1	*
Measles	1000	734	223	957	42	7	10	5	11	2	*
Scrofula	1000	700	266	966	34	10	7	4	3	1	1
Hydrocephalus	1000	918	50	968	32	9	7	4	*	1	1
Croup	1000	828	153	981	19	3	7	3	1	*	*
Whooping Cough	1000	796	191	987	13	2	3	2	2	1	*

* Less than one in each 1000.

We have previously expressed the belief that the statistics of mortality as reported in the census fairly represent the facts of mortality throughout the United States, notwithstanding the considerable omission which is acknowledged to take place in the aggregate number of deaths. It is altogether a different question, however, whether the facts of mortality as they exist in the country can, without important corrections, be held to represent, even approximately, the relations of the several elements of the population, as respects their vitality or their liability to specific forms of disease. Did no such corrections require to be made, we should best close our remarks by presenting to the Association this diagram and table without comment, for no words could add either clearness or force to the

exhibition which is herein made of the relations of race and nationality to mortality, so far as the same are disclosed by the returns of the census. Examination, however, will show that two very important corrections require to be made before the several elements of the population can fairly be put in comparison with each other as to their respective vitality, or their liability to specific forms of disease. It is to the discussion of these corrections that this paper will be mainly devoted. The necessity of the first correction is discovered by observing the proportions in which the deaths from children's diseases, represented by the seven vertical lines on the extreme right of the diagram, are divided between the native and the foreign population. The abruptness by which the lines representing the foreign elements here rise and almost run out at the top of the figure, would convince the most casual observer, either that the returns of the census were exceedingly defective in respect to deaths from these diseases, or else that some important correction requires to be made before the several foreign elements can fairly be brought, in these respects, into comparison with the native white and native colored elements of the population. Analysis of the tables of age and sex for 1870 as given in the census, shows that a most important correction does require to be made on account of *the excessive disproportion between the number of adults and of children within our foreign population.*

Giving our attention first to that disproportion as it exists with reference to children under ten years of age, we have the following facts: Total number of children under ten years of age in the United States, 10,329,426, of whom 10,070,084 are of native and 259,342 of foreign birth, that is, themselves born without the territory of the United States. These numbers yield the following proportions: Number of children under ten years of age in each 1,000 of the total population, 268; number of children under ten in each 1,000 of the native population, 306; number of children under ten in each 1,000 of the foreign population, 47. [Figures 1 and 2 of Diagram II. exhibit the distribution of the native and the foreign born population, severally, by periods of life.]

If, now, the liability to death were observed to be the same in each period of life, no correction on account of this relative deficiency of children of foreign birth would need to be introduced in a comparison of the grand elements of native and foreign, in respect to their relative vitality; but if there is observed to be an excessive liability to death at early ages, we must either eliminate all deaths at such ages before making comparison of these elements, or we must assume to add to the foreign population a corresponding number of children and to the foreign deaths a corresponding mortality among such children. As matter of fact we find that 41.4 per cent. of the whole body of deaths occur under five years of age, and 46.7 per cent. under ten years of age, while of the total living inhabitants only 14.3 per cent. were found to be under five years of age, and only 26.8 per cent. under ten years of age. [Figure 3 of Diagram II. exhibits the distribution of the whole number of deaths in the United States during 1870 according to age and sex.]

These comparisons will show strikingly what might, perhaps, have been assumed, though with less effect, the prime importance of this correction in one or the other of the two forms indicated.

Let us seek first, to exclude the deaths occurring under ten years of age. The total number of such deaths is 229,542. We do not know the distribution of this total between native and foreign. If we assume the distribution to have been according to the ratio between these two elements in the living population within the same period, the deaths of native children were 223,779 ; the deaths of foreign children, 5,763.

If, again, we assume a liability to death greater by 30 per cent. on the part of the foreign children, we have the distribution as follows: Number of deaths of native children, 222,050 ; number of deaths of foreign children, 7,492.

Deducting, successively, these numbers from the aggregate number of deaths in the total native and the total foreign populations, we have the following as the mortality in the population above ten years of age: —

First assumption, — Deaths over 10 years:	Native	200,951
	Foreign	60,200
Second assumption, — Deaths over 10 years:	Native	202,680
	Foreign	58,471

These results yield, successively, the following ratios between deaths and living inhabitants, within each of the two elements of the population: —

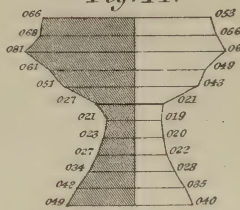
First assumption, — Deaths to each 1,000 living inhabitants over 10 years of age:	**Native**	**8.77**
	Foreign	**11.3**
Second assumption, — Deaths to each 1,000 living inhabitants over 10 years of age:	**Native**	**8.84**
	Foreign	**11.2**

It will be observed that the total foreign population under ten is relatively so small that it makes very little difference in the adult mortality what per cent. is taken (within reasonable limits) for the unquestionably greater liability to fatal disease of the children of foreign birth. But this correction on account of the number of children of foreign birth requires to be made not alone in the aggregate of deaths from all causes as above, but is even more imperatively demanded in treating of the body of deaths occurring within most specific diseases, and groups of diseases.

Thus it is evident that where the distribution by age and sex of the deaths occurring from any specified disease or group of diseases conforms substantially to the distribution of the total body of deaths by age and sex, there the correction already indicated will serve approximately for such disease or group. But where diseases or groups of diseases vary widely, as in fact most do, from the type afforded by the aggregate of deaths from all causes, in respect to the proportion of deaths occurring under ten years of age, the effect of the deficiency noted in the number of children of foreign birth will be greater or less, according as such diseases or groups of diseases

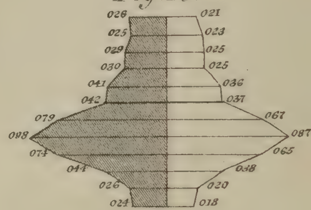
DEATHS BY SEX AND MONTH OF DEATH.

Fig. 14.



Dis. of Respiratory System.

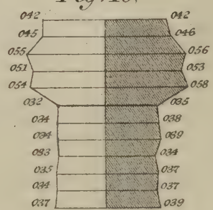
Fig. 15.



Dis. of Digestive System

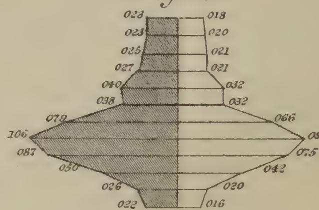
January
February
March
April
May
June
July
August
September
October
November
December

Fig. 16.



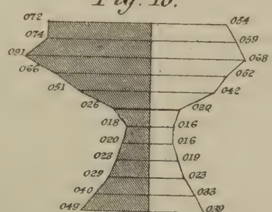
Consumption

Fig. 17.



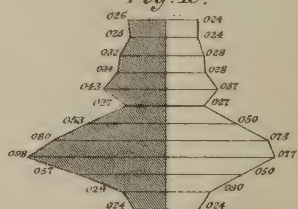
Diarrhoea, Dysentery and Enteritis

Fig. 18.



Pneumonia

Fig. 19.



Intermittent and Remittent Fevers

The total number of deaths is reduced to thousandths, and the number of thousandths within each month is represented by the distance measured on the horizontal lines, severally, from the perpendicular. Males on the left, females on the right. The sex which preponderates is shaded.

are found to be more fatal or less fatal in the early periods of life than are the whole body of diseases taken together. Thus, while of all diseases, 467 deaths in each 1,000 are under ten years of age, of the deaths from the Febrile Group of General Diseases (General Diseases "A" of the English Classification), not less than 603 in each 1,000 (Figure 4 of Diagram II.) occur under ten years of age. It is evident, therefore, that the share of the foreign element in the deaths from these diseases should be less than its share in the whole body of deaths from all diseases; and accordingly we find that, while of all diseases 134 deaths in each 1,000 occur among the foreign population, only 87 in each 1,000 deaths from this group of diseases occur among the foreign population.

On the other hand, of deaths from the Constitutional Group of General Diseases (General Diseases "B"), only 108 in each 1,000 (Figure 5 of Diagram II.) occur under the age of ten years. Now, as the foreign population consists much more largely than the native of persons within that period of life, namely, above ten years, in which diseases of this group are found to be more fatal, we should expect to find the share of the foreign element in deaths from diseases of this group much greater than their share of the total body of deaths, and of course much greater still than their share of deaths from General Diseases "A." Accordingly we find that of 1,000 deaths from diseases of the Constitutional Group, 214 occur among the foreign population. That, over and above the proper effect of the deficiency in the foreign children, peculiarities of stock, breeding, and condition may tend to produce a larger proportion of deaths from the diseases of the Constitutional Group than of the Febrile Group, among the foreign population, I do not question; but it is evident that the astonishing disproportion which appears at first sight between the deaths within the foreign population from these two groups of causes (that is to say, 87 in each 1,000 from the Febrile Group to 214 in each 1,000 from the Constitutional Group), does not wholly represent real differences in the liability to peculiar forms of disease, but mainly this abnormal distribution of the foreign population by periods of life.

Proceeding to examine in the same manner the most important remaining groups of diseases in this respect, we find that of each 1,000 deaths from all diseases of the Nervous Group (Figure 6 of Diagram III.), 591 occur under the age of ten years. Unless, therefore, the foreign population have some very marked and urgent predisposition to diseases of this class, we should expect to find their share of this body of deaths less than their share of the aggregate mortality of the country; and accordingly we find that only 95 in each 1,000 of the deaths from this group occur in the foreign population.

Strongly contrasted in this respect with the diseases of the nervous system, are the diseases of the circulatory system (Figure 7 of Diagram III.), from which only 129 deaths in each 1,000 occur under ten years of age. Unless there is some marked indisposition of the foreign population to diseases of this class, we should expect to find their share of this body of deaths far greater than their share of the deaths from all causes, and

slightly greater than their share of the deaths from general diseases "B," in which, as we have seen, 108 deaths only in each 1,000 are under the age of ten years. The results correspond to the conjecture. Of 1,000 deaths from diseases of the circulatory system, 218 occur within the foreign population.

Again, of the deaths from the diseases of the respiratory system 503 in each 1,000 (Figure 8 of diagram III.), are under the age of ten years, and the proportion of deaths from this class of causes within the foreign population sinks to 109 in each 1,000.

On the other hand, of the deaths from diseases of the urinary system and the organs of generation, including affections connected with pregnancy, only 40 in each 1,000 (Figure 9 of Diagram III.) occur under the age of ten years, and, as the foreign population consists much more largely than the native of persons within the period of life within which the great bulk of deaths from these diseases occur, their share in the mortality from causes of this class is found to be much greater than their share of the aggregate mortality, being not less than 286 in each 1,000.

Of the deaths from diseases of the digestive system, lastly, not less than 686 occur under ten years, and the deaths within the foreign population from diseases of this group sink to 98 in each 1,000.

Of the deaths from the diseases of the organs of locomotion, of the integumentary system, from parasites, from accidents and injuries, and from conditions not necessarily associated with general or local diseases, it is not important in this connection to speak.

For the purposes of this comparison, I have also taken eleven specific diseases or subordinate groups of diseases, in which the proportion of deaths under ten exceeds that of the general body of deaths. The following table exhibits the proportions maintained in these cases, the first sum against each title of disease representing the number in each 1,000 deaths from such cause or causes which occur under ten years of age, the second sum representing the number in each 1,000 occurring within the foreign population.

TABLE II.

Names of Diseases.	Number under Ten Years of Age in each 1,000 Deaths.	Number within the Foreign Population in each 1,000 Deaths.
All Diseases	467	134
Small Pox	564	132
Bronchitis	577	137
Meningitis	680	67
Encephalitis	746	47
Diarrhœa, Dysentery, and Enteritis[1]	761	113
Measles[1]	804	42
Diphtheria	854	41
Scarlet Fever	906	45
Hydrocephalus	925	32
Whooping Cough	985	13
Croup	988	19

Now, if the reason of the comparatively small number of deaths occurring within the foreign population from the above mentioned diseases, is found alone in the deficiency of foreign children, it is evident that, inasmuch as the proportion of deaths under ten is here greater than the proportion of deaths under ten from all diseases, the share of the foreign population in the deaths from each and all such specified causes should be less, and less in a degree corresponding generally to that excess of the total number of deaths under ten. If, on the contrary, we find that, as the proportion of deaths under ten increases in respect to any disease, the share of the foreign population in the whole body of deaths from that cause remains nearly the same or becomes greater than the share of the foreign population in the whole body of deaths from all causes, we have a very strong assurance that the foreign population has a decided liability to this form of disease.

Applying this principle, it will be observed that in ten of these eleven cases, the proportion of deaths from such causes among the foreign population is less than the proportion of deaths from all causes within the foreign population. This is as was to be expected, except upon the assumption that the foreign population had a peculiar predisposition to such forms of disease. In one case, however, that of bronchitis, while the proportion of deaths under ten years of age is greater by 110 in each 1,000

[1] The distribution by age and sex of the deaths from diarrhœa, dysentery, and enteritis, and from measles, severally, is exhibited in Figures 10 and 12 of Diagram III.

than the proportion of the whole body of deaths, the share of the foreign population in this body of deaths is greater by three in the 1,000 than its share in the deaths from all causes, proving conclusively the exceptional tendency of the foreign population to this form of disease in a fatal degree. In two other cases, namely, those of small-pox and of the group, diarrhœa, dysentery, and enteritis, while the share of the foreign population in deaths from these causes is less than its share of deaths from all causes, it is not less in any such degree as to correspond to the increased proportion of mortality under ten years of age; and I think it, therefore, perfectly safe to conclude from this exhibit, without further inquiry, that the foreign population have also a very distinct predisposition to these forms of disease in a fatal degree.

Looking at the eight remaining cases in the above table, we can, without deeper investigation, determine certain relations, as for example, that scarlet fever is more fatal to the foreign population than measles or diphtheria; but we cannot with assurance determine as to the comparative mortality of the native and of the foreign populations from these forms of disease without additional information, which is given in the following table, the analysis in respect to these diseases being carried down below the period of five years, the several years under five being taken separately, and the figures relating to each year under each title of disease being compared with the proportion of the total population in each such period of life which is of foreign birth, and the figures being also given separately for each five years upward to twenty.

TABLE III.

Period of Life.	Proportion of Foreign to Total Population.	Deaths in each 1000 from							
		Meningitis.	Encephalitis.	Measles.	Diphtheria.	Scarlet Fever.	Hydroceph-alus.	Whooping Cough.	Croup.
Under 1 . . .	.005	256	303	202	160	103	447	492	455
1	.010	155	167	241	158	146	259	231	197
2	.015	88	87	136	126	161	99	118	130
3	.020	47	52	79	117	144	43	59	88
4	.026	35	36	42	87	113	26	33	53
5 to 10	.036	100	101	104	206	239	51	52	65
10 to 15 . . .	.043	72	52	40	53	56	18	9	6
15 to 20 . . .	.082	60	39	39	22	16	10	2	2

Now since 103 deaths in each 1,000 from scarlet fever, to take an instance from the above table, occur under the age of one year, and as but .005 of the population within that period of life are of foreign birth, it will follow, if we assume no more than an equal liability to this disease on the part of this element of the population, that of these 103 deaths, but .515 (fractions being preserved throughout this computation) occur among the foreign children. As 146 deaths additional in each 1,000 occur between the ages of one and two, and as but .01 of the total population within this period are of foreign birth, it would follow, that of these 146 deaths, but 1.46 occur among the foreign children. In the same way, we should find that, of the 161 deaths from this cause between the ages of two and three, but 2.415 ; of the 144 deaths between three and four, but 2.88 ; of the 113 deaths between four and five, but 2.938; of the 239 deaths between five and ten, but 8.604; of the 56 deaths between ten and fifteen, but 2.408 ; and of the 16 deaths between fifteen and twenty, but 1.312 occur among the population of foreign birth, making the proportionate share of the foreign population in the 978 deaths enumerated out of each 1,000 from this disease, but 22.532. If we assume the mortality among this element of the population from this cause to be 30 per cent. greater than that of the native population, the contribution of foreign children to the 978 deaths which occur under twenty years out of each 1,000 deaths at all ages from scarlet fever, would still be but 29.6, leaving even at this extreme assumption, out of each 1,000 deaths from this cause among all classes not less than 15.4 deaths among the foreign population above twenty years of age. But as only 22 deaths in each 1,000 from this cause occur above twenty years of age, among all classes of the population, and, as the foreign element constitutes but 24.6 per cent. of the total population above twenty, it would follow that their proportional share of this latter body of deaths would be but 5.412. Hence we must conclude either that the mortality among the foreign population from this cause under twenty years must be greater than that of the native population by much more than the 30 per cent. assumed, or else that the mortality from this cause among the adult foreign population is excessive in a most extraordinary degree.

Subjecting to the same analysis the figures relating, severally, to the remaining seven diseases on our list, we have results which appear to establish a mortality among the foreign population from croup and hydrocephalus, proportionally greater than that of the native population, while measles, diphtheria, whooping-cough, encephalitis, and meningitis would seem to be less fatal to the foreign than to the native population.

On the other hand, there are eight specific diseases which may be taken for the purposes of this comparison, in which the proportion of deaths under twenty is less than that of the general body of deaths, and the share of the foreign population is accordingly greater, often in a very important degree, than its share of the aggregate of deaths from all causes. The following table exhibits the proportion maintained in these cases, the first sum against each title of disease representing the number in each 1,000

deaths from such cause which occur under twenty years of age, the second sum representing the number in each 1,000 occurring within the foreign population.

TABLE IV.

Names of Diseases.	Number under 20 Years of Age in each 1,000 Deaths.	Number within the Foreign Population in each 1,000 Deaths.
All Diseases	541	134
Cancers	58	253
Paralysis[1]	59	174
Apoplexy	78	260
Bright's Disease of the Kidneys	140	440
Consumption[1]	174	226
Hydrothorax	204	112
Rheumatism	236	193
Pleurisy	247	216

Applying to the above figures a method of analysis similar to that applied to the figures in Table III., we seem to establish beyond controversy the excessive fatality among the foreign population of Bright's disease of the kidneys, the somewhat greater liability of this element of the population to deaths from cancers, pleurisy, and apoplexy, and, on the other hand, their comparative immunity from death from paralysis, rheumatism, and hydrothorax. In respect to consumption the foreign population of the country would seem to stand in about the same relation as the native population within corresponding periods of life.

A second important correction, however, requires to be introduced before we can make satisfactory comparison between the reported mortality of the Colored and the Foreign elements of our population. This correction is on account of *the complemental location of these two elements*. Speaking broadly, where the blacks are found in the United States, the foreigners are not. There are only five (5) States in which the two elements, each in any considerable degree, are found together. These are Delaware, Kentucky, Maryland, Missouri, and West Virginia (the District of Columbia falls in this group), with an aggregate population of 4,521,929, of whom 411,558 are foreign, and 599,850 are colored. South and southwest of these lie eleven (11) States, with an aggregate population of 9,487,386, of whom 210,684 are foreign, and 3,939,032 are colored. Again, to the north and northwest of the first mentioned States are eighteen (18) States with an

[1] The distribution by age and sex of the deaths from consumption and from paralysis is exhibited in Figures 11 and 13 of Diagram II.

aggregate population of 23,544,365, of whom 4,626,809 are foreign and 334,653 are colored. The Pacific States and the territories are excluded for the purposes of this comparison. I cannot satisfy myself from the data given, whether any correction needs to be introduced on account of this complemental relation of these two elements of the population, before comparison is made between the *aggregate* mortality of the colored and the foreign elements. The correction on account of the deficiency in foreign children must, however, still be carried through in comparisons between these two elements, as the colored population of the United States is of normal growth, and contains its due proportion of persons of the early periods of life. But it is clear that the apparent liability of these two elements to certain forms of disease may be very greatly affected by this complemental location. If there are certain diseases which especially prevail at the South, it is to be expected that the colored population, being so largely found within that section, will suffer more from such diseases than the native white population which is distributed with greater uniformity over the whole country, and still more, in a high degree, than the foreign population which is scarcely represented in the lowest group of States described. On the other hand, the foreign population may, by the mere force of its location, and not by any constitutional liability, sustain a greater loss from diseases specially characteristic of the northern group of States. The range, if I may use the expression, of the two elements of the population being complemental, the question here is, whether there are diseases which are also complemental in their range, so that one of these elements may be expected to suffer more, or suffer less, by reason of location simply, than the other.

Let us compare the mortality from intermittent and remittent fevers with that from consumption. The population of the northern group of States being 61 per cent. of the total population of the country, we find 69.5 per cent. of the deaths from consumption and 30.1 per cent. of the deaths from intermittent and remittent fevers occurring in this group. The population of the middle group of States being 11.8 per cent. of the total population of the country, we find 11.9 per cent. of the deaths from consumption, and 14.1 per cent. of the deaths from intermittent and remittent fevers occurring within this group. The population of the southern group of States being 24.6 per cent. of the total population of the country, we find 16.2 per cent. of the deaths from consumption and 53.7 per cent. of the deaths from intermittent and remittent fevers occurring within this group.

It is clear, therefore, that the diseases thus taken for comparison are in a high sense complemental as to their range. There is a middle belt, in which the two are in a degree found together, a northern group in which the first is found in a very high, and the second in a very low degree, and a southern group in which these relations are reversed.

It is evident, therefore, that in respect to these diseases, the colored population of the South ought to be compared with the foreign population of the South, and not with the foreign population of the whole country;

and, on the other hand, the foreign population of the North ought to be compared with the colored population of the North, and not with the colored population of the whole country.

I have treated according to this plan four important diseases and subordinate groups of diseases, which are known to have exceptional relations to temperature, with the following results : —

TABLE V.

Names of Diseases.	The United States.			The Northern States.			The Middle States.			The Southern States.		
	Native White.	Native Colored.	Foreign.	Native White.	Native Colored.	Foreign.	Native White.	Native Colored.	Foreign.	Native White.	Native Colored.	Foreign.
Population	727	127	144	789	14	197	776	133	91	563	415	22
Consumption	662	112	226	697	32	271	659	200	141	537	400	63
Diarrhœa, Dysentery, and Enteritis . . .	763	123	114	847	13	140	804	102	94	530	418	52
Intermittent and Remittent Fevers	648	256	96	831	18	151	782	94	124	505	441	54
Pneumonia	688	194	118	799	27	174	746	168	86	475	501	24

The greater liability of the colored population to malarial than to intestinal diseases in the northern and in the southern States, with the reversal of this proportion in the middle group, the high rate of mortality among the colored population from consumption in the northern States (32 : 14), being rapidly reduced as we pass through the middle belt (200 : 133) until it falls below average (400 : 415) in the congenial climate of the South ; the wider liability of the same race to the acuter form of lung disease, not so excessive in the North, but more fully sustained through the transition southward (27 : 14, 168 : 133, 501 : 415) ; the increasing fatality of each specified form of disease as the foreign population moves southward, most marked, however, as is natural, in the case of the two groups of diseases especially characteristic of the South ; and finally the uniformity with which the native white population contributes to the mortality from each specified cause in each section of the country by turns, as contrasted with the fluctuations among the colored and the foreign elements of the population, — these are the most noticeable features of this table. As the diseases mentioned are the cause of 32.1 per cent. of all the deaths occurring in the country, the importance of this discussion of their complemental relation cannot be exaggerated.

[1] The statistical proof that these diseases sustain important relations to temperature, is exhibited graphically in Figures 14 to 19 inclusive, of Diagram IV.

In the use of the above table, it should be noted that while before comparing the foreign population within any geographical section, with either the native white or the colored population of that section, the connection heretofore noted as required on account of *the deficiency of foreign children* must be made, the foreign population in one section may, without any such antecedent correction, be compared with the foreign population of any other section,[1] as the deficiency of foreign children may, for the purposes of so large a comparison, be assumed to be uniform as between sections.

Such being the readiness and the (comparative) certainty of comparisons between the several constituents of the foreign population, we present in the following table the contributions, in parts of 1,000, made by each specified foreign nationality to the total number of deaths from each enumerated cause, within the total foreign population.

TABLE VI.—A.

Groups of Diseases.	Total Foreign.	Irish.	Germans.	English and Welsh.	Swedes, Norwegians and Danes.	Scotch.	French.
All Diseases	1000	410	282	108	34	27	25
General Diseases—A . .	1000	282	329	101	78	22	23
General Diseases—B . .	1000	454	276	90	24	26	23
Dis. Circulatory System .	1000	431	279	134	18	26	30
Dis. Urinary System and Organs of Generation .	1000	442	289	108	22	25	21
Dis. Respiratory System .	1000	408	287	112	29	27	29
Dis. Digestive System . .	1000	379	280	121	51	28	27
Dis. Organs of Locomotion	1000	477	231	108	28	38	33
Dis. Nervous System . .	1000	378	292	142	21	36	27
Dis. Integumentary System	1000	417	236	160	17	27	22
Conditions not necessarily associated with general or local diseases . . .	1000	478	260	101	12	32	27
Accidents and Injuries . .	1000	424	251	125	30	23	22
Other and Unknown . .	1000	461	243	88	38	23	20

[1] The native white and the colored population may be compared with each other in any section, without any important correction, both elements being of normal growth.

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TABLE VI.—B.

SPECIFIC DISEASES.	Total Foreign.	Irish.	Germans.	English and Welsh.	Swedes, Norwegians and Danes.	Scotch.	French.
Bright's Disease	1000	576	213	110	13	28	8
Apoplexy	1000	381	328	139	9	28	34
Cancers	1000	412	307	117	11	41	39
Consumption	1000	478	262	84	25	24	20
Rheumatism	1000	392	284	103	39	30	36
Paralysis	1000	409	253	173	11	41	26
Cerebro-spinal, Enteric, and Typhus Fevers	1000	302	332	90	88	20	24
Pleurisy and Hydrothorax	1000	380	299	99	19	36	43
Bronchitis	1000	534	228	87	16	25	31
Small-pox	1000	203	441	36	25	3	24
Pneumonia	1000	413	284	116	27	29	29
Diarrhœa, Dysentery, and Enteritis	1000	384	271	118	66	30	28
Erysipelas	1000	358	309	133	29	44	23
Intermittent and Remittent Fevers	1000	328	335	83	34	18	45
Encephalitis and Meningitis	1000	332	301	121	38	34	21
Scarlet Fever and Diphtheria	1000	192	283	189	75	28	7
Measles	1000	175	240	123	255	39	8
Scrofula	1000	287	218	113	78	17	26
Hydrocephalus	1000	277	231	139	15	23	31
Croup	1000	163	366	159	64	25	10
Whooping-cough	1000	153	254	161	178	68	—

The following appear to be among the most noteworthy features of this table:—

Among the Irish, a comparative exemption from all the general diseases of the Febrile Group, and from diseases of the digestive and nervous systems; and, on the other hand, a marked liability to general diseases of the Constitutional Group, including consumption, but with exception of rheumatism, scrofula, and cancers, and to diseases of the organs of locomotion and of the urinary system, with extraordinary mortality from Bright's disease of the kidneys.

Among the Germans, a reduced mortality from general diseases of the Constitutional Group, and a decided liability to those, especially small-pox, of the Febrile Group (being an exact reversal of the relations of the Irish thereto); a comparative immunity from diseases of the organs of locomo-

tion and of the integumentary system, and otherwise a general evenness in the distribution of the body of deaths among the several groups of diseases, and through the list of specific diseases.

Among the English and Welsh, a liability to the diseases of the nervous, circulatory, digestive, and integumentary systems contrasted with comparative immunity from general diseases, both of the Febrile and the Constitutional groups; of the specific diseases, scarlet fever, diphtheria, whooping-cough, hydrocephalus, croup, erysipelas, apoplexy, and paralysis being relatively most fatal, and consumption, intermittent and remittent, cerebro-spinal, enteric, and typhus fevers, bronchitis, and small-pox, least fatal.

Among the Swedes, Norwegians, and Danes, a marked liability to diseases of the digestive system, especially dysentery, diarrhœa, and enteritis, and an extraordinary mortality from general diseases of the Febrile Group, notably measles, scarlet fever, diphtheria, and typhus, enteric, and cerebro-spinal fevers, with comparative immunity from general diseases of the Constitutional Group, and from diseases of the circulatory, nervous, urinary, and integumentary systems, and of the organs of locomotion, the deaths from cancers, apoplexy, paralysis, bronchitis, hydrocephalus, and Bright's disease of the kidneys being remarkably small.

Among the Scotch, an evenness in the distribution of the body of deaths among the several groups with marked exception only of the diseases of the nervous system and of the organs of locomotion, the most noticeable exemptions among the specific diseases being small-pox, scrofula, and the fevers; the most noticeable instances of liability, cancers, paralysis, erysipelas, measles, and whooping-cough.

Among the French, a general evenness in the distribution of the body of deaths among the several groups of diseases, with somewhat more of irregularity as to the distribution among the specific diseases than among the Scotch.

PERFECTION OF STRUCTURE IN THE HUMAN BODY, AS A LEADING ELEMENT OF HYGIENE.

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THE subject of longevity has always attracted much attention. The arts and means of prolonging life were frequently made the themes of discussion, long before the real structure and functions of the most important agency in the human body were discovered. But as the principles of physiology have of late years become better understood, new interest has sprung up in relation to all matters pertaining to health, and the inquiry is very generally raised, at the present day, What are the best means of preserving life, and thus securing the boon — longevity. Now, may there not be a great general principle or law, grounded in physiology, which may serve as a guide in these matters, and help to illustrate and explain all minor facts or secondary considerations? Is there not some standard or model established by Nature herself, to which we may always appeal, and by which all doubtful questions here may be tested? From our knowledge of the laws of nature, as well as of the principles of science generally, we should naturally infer that there must be found in physiology some such general law, or such standard.

Several years ago, after somewhat extended observation, and no small amount of reflection and reading, I became convinced that there existed a great general law of population, or increase, as a fundamental principle in physiology, and that this same law of propagation (subject to certain conditions) extended throughout the whole animal and vegetable kingdoms. If such a law in nature does exist, it might be inferred that it would have some connection with the greatest amount of health and longevity.

Law of Propagation. This law may be briefly defined as follows: it is based upon a perfect standard of organization, or consists in the perfectionism of structure; or, in other words, that every organ in the human body should be perfect in structure, and that each should perform its legitimate functions in harmony with others. Taking this, then, as a standard, we have a great law or principle pervading all organic matter, that furnishes a guide by which all deviations from this model, and the manifold changes that follow, may be explained and understood. While this law is subject to certain conditions, as food, climate, exercise, etc., all these act as secondary agents or factors. They may modify the operation of the law, but cannot change its nature or general character.

Evidences in proof of such a law may be deduced from physiology itself, from pathology, from the laws of hereditary descent, from the effects of

intermarriage of relations, from facts gathered in the history of different families, and changes in numbers, as applied to distinct classes, races, and nations. But without dwelling upon these points, we maintain that the organization upon which this law of propagation is based, presents also the only true standard in physiology for the greatest amount of longevity, of health, of physical strength and happiness, as well as of beauty in form and outline.

Law of Longevity. But it is proposed to consider here only the application of this law to longevity. By this term is meant long life — the greatest duration of human life, whether in isolated cases or in large numbers. Where, then, are these cases found, what is their character, and what are the facts attending them?

In the first place, it is very evident that long life is not dependent alone upon food, nor upon climate, nor upon exercise; neither is it found in any one locality, nor with any one people, nor in any particular station; neither where great riches nor excessive poverty abound. It is sometimes found in the city, but more generally in the country.

All must admit that some of these conditions are very important, and that good health and long life must depend greatly upon the manner in which the relations between the various parts of the system and these external agents are carried on. But after all, may there not exist a general law in the body itself upon which these depend? If we had perfect standards of organization around us upon which this law is based, its truth would be more easily demonstrated; but instead of such, we have only approximations, and these in almost endless variety and form. In order that we may have a clearer and more definite understanding of the foundation of this law, let us carefully examine its physiological conditions. Every animal organization is complex, — is composed of many distinct organs. Each organ has a specific work to do, and in its normal state must do so much and no more. Now in the healthiest and most perfectly organized structure, all these separate organs are found, not only in a perfectly healthy condition, — each one performing its own normal functions, — but well balanced and working harmoniously together. In this state "the wear and tear," or the demands which nature makes to support life and carry on its operations, come upon all these organs alike, each according to its own nature, without infringing upon that of any other.

In the promotion of health and longevity, too much stress cannot be attached to the importance of preserving this harmony or balance of organization. In some respects, the human body may be compared to a perfect machine, made up of many complicated parts. How different the working or running of such a machine from that of one imperfectly constructed and unequally balanced in all its parts! The one seldom needs repairs, the other frequently. The one will last as it were for an age; the other becomes almost useless in a short time.

It is so in reference to the human system. Whenever a certain organ or class of organs becomes relatively too large or too small, causing a want of balance or harmony in their action, there must be in the very

nature of the case far greater liability to disease. Accordingly, it is in persons possessing this imperfect, ill-balanced organization, that we find, not only the greatest amount of sickness, but that which is most obstinate and fatal. How often it happens that some slight derangement or trifling weakness operates as the entering wedge to the most serious diseases! It is the weak spot caused by inheritance, or developed by exposure, where disease finds its germ or starting point, though all other parts of the system are in a perfectly sound condition; and not unfrequently life is terminated by a single organ, or even some part of it, giving out, when all the other organs might have performed their healthy functions for many years.

We dwell upon the importance of this harmony or balance of action in the vital forces, for it is the great secret of good health and long life. It is a cardinal point in the law of longevity, as will appear from a more full sketch of its foundation.

Perfect Structure and Harmony of Function. It is upon this perfect structure or anatomy of the body, combined with the normal action of all its physiological functions, upon which we base this law of longevity. It is true we have no such perfect standards or models of human organization now existing, but only approximations towards them. Still the law may apply to such as we have, just as well as the general law of gravitation or attraction to the smallest-sized bodies. We can readily conceive of such standards, and how the same law that governs them may be applicable to their representatives of whatever grade or character.

All the pains, the weaknesses, and the diseases of the human body are but the result of deviations from this normal state; and all the means and agencies employed for the preservation of health and life look towards restoring this standard. It is well known that there are influences constantly operating to produce changes, both in the structure and functions of the system. Some of these agencies have their origin internally; some act entirely external to the body, and others operate by what are called laws of heredity. By some of these influences the physical system is improved and perfected, but by others the deviations from a healthy standard are increased more and more. Probably the most powerful of these forces is that of inheritance. This agency constitutes a very important element in the law of longevity. All writers upon this subject place this condition as first and foremost — that one of the almost indispensable requisitions for long life, is good healthy stock, or long-lived ancestry. For it has been found by universal observation and experience, that the representatives of such stock live the longest, and that very seldom, if ever, are found persons of great age originating from feeble and short-lived ancestry.

Law of Inheritance. Now what is the secret of this transmitted power that conduces so much to longevity? May there not be some general principle or law involved in these changes from hereditary influences, which may aid us in explaining the why and wherefore? We know well the effects of such power, but what is the explanation, what is the philosophy

involved? Under the law in nature that "like begets like," and that when the producing forces are sound and healthy, it is found that their offspring will partake of the same character; and that under favorable circumstances this may be continued for several generations. Sometimes there is an improvement in the stock; but not unfrequently a deterioration, especially after three or four generations.

Now what is the peculiarity or type of organization here perpetuated? What are its elements or constituents? What makes it long lived? Do we not find that it consists in a sound, healthy structure of every part of the body, and that there is a remarkable balance in all the organs and harmony of functions? We venture the assertion that such will be found the character of this organization in every instance, and that there are no exceptions to the rule. Does not this, then, afford evidence that there is a general law in nature conducive to longevity, and that this law is based upon that organization which is most perfect, and all of whose functions act most harmoniously? Let us apply the rule to such individuals and families reaching a great age, that have come under our own observation. For many years I have verified the fact in numerous cases, and have never found an exception.

There is another point of view whereby this law may be tested. Certain physiological conditions have been laid down by some writers as sure indications of longevity. These conditions embrace the healthy performance of the functions of all the leading organs of the body, and may be summed up under these heads: Respiration, Digestion, Circulation, Assimilation, and Secretion. Where all the vital forces connected with each of these departments of physiology are found to operate regularly and vigorously, they are thought to be the sure indications and precursors of longevity. Now what does this imply but soundness of structure and harmony of function? Let any one of these fail in the least of performing its part, and all suffer. Does not this view of longevity, then, furnish strong evidences in favor of the law which has been set forth in this paper?

Signs of Longevity. There is another class of facts which has an important bearing upon this question. These are what are denominated the physical signs of longevity. There must be a symmetrical development of the whole body. The head must not be too large or too small. The neck must not be too long or too slender. The chest must be well developed, but the abdomen must not be too large. The whole body must be well proportioned, not too tall nor too short. No class of organs must be too predominant; or, in other words, the temperaments must be properly mixed or blended, especially the nervous and the sanguine possessing more of the vital organs, must not be very conspicuous. There are some minor signs, such as the voice, the teeth, the color of the eyes and the skin, the quality of organization, etc.; but when we sum up all the foregoing signs, do they not clearly point to a harmony or balance of all the organs of the body, and thus confirm the truth of the law of longevity as here advocated?

There is a large body of facts also connected with the cure and preven-

tion of disease, that has a direct bearing upon this subject. All sound medical treatment and means for the promotion of health, operate in harmony with this great law of longevity. They aim to restore the normal structure and healthy functions of every part of the body.

In all works treating of longevity, great stress is laid upon the influence of climate, food, air, water, exercise, etc. Statistics show that while the extremes of either heat or cold are not conducive to long life, a moderate climate in countries where the changes of temperature are neither too great nor too sudden, is decidedly favorable. But even here there must be a strict observance of hygienic laws. In relation to the right kinds of food and drink, pure air, healthy localities, dwellings, employments, etc., however important, they are all secondary agencies, and operate under and in harmony with one great general law.

Mental Hygiene. But there is still another class of facts differing from any of those mentioned, that has a powerful influence upon longevity, viz., the influence of mind upon the body. Mental training, a well-balanced mind, a cheerful, contented disposition, and temperate habits, are, with rare exceptions, found indispensable. Now these presuppose a harmonious development of the whole body, and particularly of all parts of the brain. For it is impossible, we believe, to obtain the qualities here mentioned in a high degree without these two conditions. And the nearer this development approaches that standard of organization upon which is based the great law of longevity, the greater will be not only the aggregate amount of health, but the longer the duration of human life. This statement will be found abundantly verified in the history and character of persons who have reached a great age.

This interdependence of body and mind is becoming every year better understood. It is found that the relations of the mind to the body, and of the various states and changes of physical organization to the mind, have a powerful influence upon health. And the more marked and abnormal the differences in this relation, the more striking are the effects. If, then, health is so dependent upon the state and relation of these two agents, the duration of human life must be most sensibly affected by it. And we venture the assertion, that the more thoroughly this particular feature of the subject is investigated, the more important and far-reaching will be found the influence of these reciprocal relations. The evidences derived from this source will go far, we believe, towards proving that nature has established a certain harmony or equilibrium of action between the body and the mind, and the more perfect that development and harmonious the performance of their respective functions, the nearer is the approach to that standard of organization upon which is based the law of longevity.

This view explains, in part, why the average age of man has been increased by education, and that the greatest longevity is found among nations most highly civilized. In confirmation of this remark, a distinguished writer says: "That type of civilization in which the efficiency of the community and of the individual is greatest, in which there is the most harmonious action between the body and the mind, the greatest happiness

of the greatest number, the least excessive expenditure with the least luxury, where regularity and temperateness are innate characteristics, will be that state of civilization most favorable to longevity." It is scarcely necessary to say that such a type of civilization could not exist without well developed physical organizations generally, and a harmonious action of all the mental faculties.

Another well-known writer on this subject, after enumerating among the prerequisites to longevity, temperate and regular habits, a cheerful and contented disposition, says there must be not only an equilibrium of the mental faculties, but a descent from long-lived ancestors, a tranquil and happy temperament, and general symmetry of physical conformation, and harmonious proportion of all the different parts and organs of the body.

Numerous quotations might be cited from other authors, and many additional facts might be gathered from various sources in support of this theory of longevity; but our present limits will not permit. Perhaps the theory of one writer should not be passed by unnoticed, inasmuch as it may be thought to have some resemblance to the one here presented.

Theory of M. Flourens. M. Flourens, in a very elaborate treatise, maintained that man ought by virtue of his natural constitution, to live a hundred years, and that this natural term of life is abridged only by his own improvidence, follies, and excesses. The length of human life he attempts to establish by the law of growth and by analogy, viz., that every animal will live, on an average, five times the period of his growth. Thus, as it is found by anatomy that it takes, on an average, twenty years for man to reach his perfect growth, especially the bony structure, the limit of life would be one hundred years. Flourens held that neither climate, nor food, nor race, nor any external condition, had much to do with the duration of life, but this depended almost wholly upon the natural constitution, and the intrinsic vigor of all the organs of the body. But he does not define very clearly how this natural constitution is based upon the anatomy and physiology of the system, nor attempt to show what are its laws and relations to the external world. We all know that climate, food, and other external agents have a powerful influence upon the development and preservation of the body. One great defect in his theory is, that he does not point out distinctly the great laws of health and life, as based on physiology and external nature, which extend not only through individual existence, but are universal throughout creation. As to the question, What is the natural period of human life, provided all the conditions are favorable? perhaps he is not so much out of the way, though the testimony of most writers would place the limit somewhat less. Flourens presents us no standard of organization as a perfect model of imitation, and upon which the great laws of health and life must be based. If we take into consideration the structure and functions of the human body, — the design of its existence, and its adaption to external objects, — there must be certain relations and fixed laws that govern in all these matters. For illustration, there is a fixed law that exists in the relation of pure air to the healthy functions of the lungs. It is so in reference to all other parts of the body. Now it is in the summing up of all these

laws as applied to a perfect organization, that we find the law of longevity. All the great laws of nature that are fixed and universal, are invariably found based upon her works in a normal state, or in their most perfect development. As in painting and statuary the artist has constantly in his mind an ideal model, a typical standard which no living beings have ever reached, but only made approximations to, so in physiology it is easy to conceive of a standard which represents an organization in its highest state of development. It was with reference to the making up and arranging the constituent elements which enter into such a standard that led the most profound physiologist in our country, Professor Draper, to make this remarkable statement: "The approach to precision in these hypothetical constants will in all times be a measure of the exactness of physiology, and, it may be added, also of the practice of medicine. The time is at hand when such a typical standard must be the starting point for pathology; and no rational practice can exist without it. The passage of physiology from a speculative to a positive science, is the signal for a revolution in the practice of medicine."

Advantages of the Law of Longevity. The question may very properly be asked, Supposing there is such a law of longevity, what are its advantages? We answer, many and great. It is not a mere speculative theory or vague hypothesis that cannot be comprehended or applied to any practical purpose. It harmonizes not only with all the well-known truths of physiology and pathology, but is sustained by all the agencies employed by nature or art for the protection and preservation of life. In fact, it is that great general law established by the Creator himself for perfecting and prolonging the life of every human being, of which all minor laws are a part and parcel. It holds up before us that perfect form and image in which man was created, and presents an embodiment of those laws and conditions with which we must comply in order to secure the greatest amount of happiness and the longest duration of life. With such a standard constantly before us, shall we not make greater efforts to conform to it than if we had no such conception? Besides, by means of understanding the various deviations from this perfect standard, we obtain a better knowledge of the infirmities, the liabilities, and the weaknesses of the human system. It presents a new stand-point from which to survey the causes of disease as well as the agencies employed for its cure and prevention. It gives us a clearer and better understanding of the principles of hygiene and sanitary laws, and enjoins the absolute necessity of observing them, if good health and long life are to be secured. It shows that all the changes which occur in the human system are subject to law; that disease, of whatever type and character, or wherever found, is a violation of law; and all treatment and remedies, whether provided by nature or art, must be viewed as agents or means to repair the injury.

Applied to Life Insurance. But there is one use to which this law may be applied, of incalculable value. We refer to Life Insurance. This is becoming an immense business, scarcely surpassed in interest and magnitude by that of any other in the country. From the best sources of information, it is estimated that there are over five hundred thousand or half a million

lives insured in over two hundred different companies, and the amounts invested and at risk would startle one not accustomed to figures. The largest proportion of this business has sprung up within twenty or thirty years, and what is singular, the larger the business and the wider its expansion, the greater the changes in its management and the more uncertain are its results. We should naturally suppose that time and experience would give permanence and stability; but what a sad spectacle is presented by the rise and fall of so many life insurance companies as have occurred, some of them, too, after many years apparently of successful experience! What a history of wrecks, losses, and disappointments does it exhibit! Scarcely can a parallel be found in the history of any other incorporated business in the country.

Commencing more than thirty years ago as an examiner for life insurance, appointed by the London Loan Office, and having since been connected as an examiner with several other companies, I have become more and more convinced that there was here room for great reform. But there are some questions on this subject of great interest, which we cannot now discuss, but which, under other circumstances, might claim attention; our present object is simply to show wherein this law of longevity may be applied with great success to life insurance.

In the examination of any organic structure, with reference to forming an estimate of its continuance, we must understand correctly its nature and construction, as well as the laws that govern its action. If it is made up of many parts or distinct organs, we must comprehend fully their relations to each other and to external objects. But in order to make the best use of such knowledge, and form an intelligent estimate of results, we want some general law or standard of appeal, which shall be applicable to the whole. To any one acquainted with the earlier history of the different sciences, it is well known what great advantage was found when a large body of facts or amount of knowledge had been obtained, that by the discovery of a general principle all these facts and this knowledge could be more systematically arranged and satisfactorily explained. It is somewhat so in applying this law of longevity to life insurance, though it may be subject to many conditions and cannot be reduced to mathematical accuracy.

Prerequisites of Longevity. Without explaining again this law and its conditions, let us briefly notice some of its applications in determining the prospect or continuance of life. All the essential elements or prerequisites for longevity may be conveniently arranged or summed up under three distinct heads, namely, *constitution*, *inheritance*, and *obedience to law*.

1st. It furnishes the examiner for life insurance with a standard of organization with which the constitution of all persons examined may be compared, and which will assist in forming a correct judgment of their soundness or in detecting the physical deviations from a normal standard; then what are the liabilities to disease, and what the prospects or probabilities of life. Without such a standard or guide we have no general rule to test the soundness or strength of the constitution. It must depend very much upon opinion merely, which, of course, will vary according to the

differences of judgment in different individuals. With such a model constantly before us as nature has furnished, we can understand more exactly and fully the relations which all parts or organs of the body sustain, one to another, as well as to external nature; and then we can calculate or forecast far better the changes to which they may be subjected. The more of such knowledge we possess the more accurately can we estimate the continuance or prospect of life.

2d. All writers upon life insurance lay great stress upon inheritance or a long-lived ancestry. This has been found by universal experience, to be one of the prerequisites, in fact an indispensable condition of long life. Now, why — why is this so important? What are the reasons, what does it mean? What is the rationale of it or what lessons does it teach? Does it not clearly and distinctly imply, that if there is any truth in this power of inherited organization for long life, — the more perfect the organization, the greater the power, — there must certainly be found somewhere in nature a great general law of longevity? The influences of hereditary descent have as yet received but little attention compared with their importance, even by the medical profession, and before they can ever be thoroughly understood, it will be found, if we mistake not, that there exists in physiology as a fundamental principle, a general law of propagation, and as a part and parcel of the same, will also be found this law of longevity. In the matter of life insurance, a thorough knowledge of these hereditary influences is of the utmost importance.

3d. *Conditions of Health.* Obedience to law. This has a very wide application, including all the physical laws and relations of body and mind. The better these laws and relations are understood and the more strictly all are observed, the greater will be the amount of health and the longer human life. But in order to effect this most successfully the conditions of good health must first be fully understood, such as pure air and water, wholesome diet and drink, healthy vocation and residence, regular hours of exercise and sleep, temperate habits, right mental and moral culture, with a cheerful, contented disposition.

With the increased knowledge and observance of these laws of health, many individuals have not only prolonged their own lives, but the average duration of human life within forty or fifty years has considerably advanced. But physiology in its practical applications is yet in its infancy. When its principles become so generally understood and appreciated as to be practically applied throughout the community, in every family and by every individual, then will be found a great diminution of disease as well as of early mortality. Now, by having a true standard of organization for testing a good constitution and by understanding correctly the laws of hereditary descent, it gives us new and more definite views of the various conditions of health. In the examination of persons for life insurance all these laws or conditions must be taken into account, and after careful and thorough investigation, it will finally be found that all these principles and agencies operate in harmony with, and are based upon, one great general law in nature — the law of longevity.

The question may still be asked, Wherein, how, or in what way more in detail, can this law be made practical? To answer this question fully would require a volume. Only two or three further suggestions can here be offered.

It points out directly the true means or sources of health and life, — that there is no fortuitous chance or mystery in them, but that they are all governed by laws which can be understood and obeyed. It expounds correctly the great laws of inheritance which furnish the ground-work — the prerequisites for good health and long life. It explains the absolute necessity in the outset, of a sound constitution, of a well-balanced organization. It shows the relation and importance which human agency holds in propagating a sound and healthy stock. It teaches every individual more clearly what are the peculiarities and weaknesses of his own constitution as well as what are his particular dangers or liabilities to disease. It is this exact, this definite and personal knowledge that may be turned to the greatest account in the prevention of disease. If every individual in the community could be thus made acquainted with his own physiology together with the laws of hygiene, we should soon see a most surprising difference in the relative amount of sickness as well as of early mortality.

THE GENERAL CAUSES OF DISEASE.

By WM. CLENDENIN, M. D.,

Of Cincinnati, O.

THE imperfections and general incompleteness of the science of physiology present the greatest obstacle to the prosecution of the study of the origin and causation of disease. Upon the accuracy and extent of our knowledge of physiology and pathology must depend in a great measure a proper appreciation of the sources of disease and an intelligent application of preventive methods, on a large scale. It is obvious that the means which advance the one will aid us to a more perfect knowledge of the other. We are at the outset compelled to acknowledge that the facts required for sanitary investigation are, for the most part, unrecorded ; hence, not available. An accurate registration of deaths in a community furnishes, it is true, much valuable information not otherwise to be obtained ; but a mortuary record does not present a proper basis for correctly estimating the prevalence or extent of any particular type of disease not necessarily fatal in its character, and affords no indication as to the method by which such diseases are to be guarded against or prevented, and too often the information afforded by such records reaches us at a period too remote to be made available for sanitary research.

The registration of all the cases of the commonly prevalent diseases of a community or locality, among such portions of the population as may be necessary, would be the most correct method of forming an estimate of the state of the public health. It is certainly practicable to register the more prevalent maladies of a community, a mining district, or manufacturing establishments, — likewise of a city or populous district. Such a registry of disease would bring to light many causes of sickness hitherto unrecognized and thus enhance the means of improving the public health. Much time is generally lost after the outbreak of a disease before the facts are made known to the sanitary authorities ; hence valuable lives are sacrificed, suffering and poverty often result, and the opportunity is lost of ascertaining the source or cause of the disease and of limiting or preventing its spread. A systematic registration of all cases of sickness, whether fatal or not, would instruct the sanitary authorities as to the state of the public health and furnish them with the advantages afforded by the speediest information.

We should observe that no inconsiderable difficulty attendant upon the study of causation arises from our overlooking and ignoring the influence of what are apparently unimportant circumstances. The wonderful advances of knowledge through the agencies of the microscope and the laboratory have, in a measure, carried us beyond the consideration of causes that are both general and constant, though these often be of sufficient force to impair health, or even destroy life. For example, we are indifferent to the

sources and prevention of such diseases as are quite common with the phenomena of which we are familiar, while other diseases of less frequent occurrence and less destruction to life, prevailing only at long intervals, or attended with alarming symptoms, receive the full attention of physicians. Thus the most terrible apprehension is aroused by the actual advent of Asiatic cholera ; all who can possibly do so flee from cities and towns thus invaded, and sanitary measures are hastily improvised by the local authorities; and yet an epidemic of Asiatic cholera sweeping over our country is not, during the period of its prevalence, as destructive to human life as many other diseases which do not excite alarm and rarely even attract attention. During the cholera epidemic of 1849 and 1850 (in the United States), the deaths by this disease are reported to have been 31,506, while during the same period there were 32,874 deaths from other forms of disease of the intestinal canal, and the number of deaths by fever was greater than those by cholera.

Each period of human life seems to be marked by a special susceptibility to certain diseases ; the deaths during infancy, youth, mature life, and advanced age, are each assigned in the aggregate, to special or certain causes. Do we therefore conclude that the diseases incident to these several periods of existence, are produced by special causes, and that those causes are active and present only during the stage of life referred to ; or has this liability to certain diseases at certain ages of life, its origin in the state or condition of the developmental or nutritive process, or of certain organs only? If the latter be the real cause, are we therefore powerless, and are the results to be regarded as inevitable? But a careful examination of all the facts in the case, will, it is believed, show conclusively that there are no general or special causes, or conditions, existing and affecting persons of one age, that do not exist at every other period of life. The exceptions, if any exist, are very few.

In the enumeration of causes of disease the greatest prominence is given by authors, to certain physiological processes — to the establishment and cessation of the functions of certain organs of the body. What a train of childhood's ills is supposed to follow the evolution of the primary teeth ; and, at the age of puberty, how many diseases are attributed to the catamenial flux, and later in life, to its cessation.

It is humiliating to consider the excessive mortality among young children in American cities ; one third (nearly) die in the first year, and one half before they have attained the fifth anniversary of their birth. Is mankind weaker and possessed of less vitality, or more susceptible to disease than it formerly was ; is it exposed to more danger at present than during an earlier period of the world's history ; have diseases increased in number and fatality ; or do the requirements of society and the results of our social system, added to the omnipotent behests of custom and fashion, create new sources of a more permanent interruption of the sense of well being?

Among the various causes assigned for the great mortality among children, "teething" seems to be the most common. Almost every disease incident to childhood is regarded by medical men, and also by others, as being

the result of pain produced by the eruption of the milk teeth. "The cutting of the milk teeth," Marshall states, "is doubtless, in many cases, though *not necessarily*, a painful process." If it is not necessarily a painful process, it is certainly very important to know when, or under what circumstances, or conditions, it becomes so. The primary teeth begin to appear about the seventh month, and perfect their series at the expiration of the second year.

The statistics of the public health departments of this and of other countries, demonstrate that the highest death-rate among children occurs during the first six months of infancy, and consequently before the teeth begin to appear; the next highest rate of mortality occurs during the last six months of the first year of life. The mortality tables everywhere show that the death-rate among children steadily and perceptibly diminishes from and after the fourth or fifth month of child-life; that is, after the time at which the teeth generally begin to appear; for example, 7,499 children died in New York during the year 1867, whose ages were less than one year; of this number 891 died during the first week; 884 between the first and fourth week; 945 between the fourth and eighth week; 885 during the third month; 1,613 between the third and sixth month; and 2,281 during the remaining six months of the year. In Cincinnati, during the last six years, 6,766 children were reported to have died under one year of age; of this number, 801 died during the first week; 778 between the first and fourth week; 824 between the fourth and eighth week; 703 during the third month; 1,546 between the third and sixth month; and 2,014 during the last half of the year. These figures show very conclusively that the greatest sacrifice of child-life occurs at a period when dentition could not have sufficiently advanced to produce any injurious impression upon the delicate nervous system of the child.

To what causes, then, may we properly and correctly ascribe this difference in mortality, and what is it that so strongly predisposes the child of three months to diseases which one of as many years would successfully resist or escape altogether? In healthy localities the death-rate of children under one year of age ought not to exceed one in six; but in some of the cities of this country it is one in three.

The records of the various public health organizations of this country show that the diseases most destructive to life, in children under one year of age, are the same that, with rare exceptions, cause the death of those a year or so older, namely, convulsions, congestion and inflammation of the brain, hydrocephalus, atrophy and debility, diarrhœa, cholera infantum, pneumonia, etc., etc.

There are certain physiological changes taking place coincident with teething but in no wise consequent upon it, which may become pathological. During the early period of childhood the food is taken into the stomach by a sucking process; there is neither mastication nor insalivation, properly so called; the glands of the stomach and intestines are at this period only sufficiently developed for the digestion of albuminous liquids; subsequently (and during the period of first dentition), the salivary glands enlarge and become active, and hence the cause of the "drooling" so often witnessed,

and supposed to be caused by the irritation of teething; the glands of the stomach and intestinal tubes undergo a simultaneous development, preparatory to, and necessary for, the digestion of starch and fats. During these changes there is necessarily an increased flow of blood to these numerous glands, and, under favoring circumstances diarrhœa and other diseases *of the bowels or stomach* and assimilative organs may ensue.

The popular opinion in reference to dentition as a cause of disease often leads to the sacrifice of life. It lessens the appreciation of true causes, and diverts attention from them. If a child is taken sick during the period of teething, the parents, deceived by this popular opinion, attribute the child's sickness to this cause, and do not suspect the existence of any other. The real cause of the disease is not, therefore, discovered at all, or if so, not until too late to successfully combat the evil.

Among children, sickness and mortality follow the months, and, in cities, it is generally increased from fifteen to twenty per cent. by the heat of summer; there is also, perhaps, a slight increase over the average during the winter months; and yet mortuary tables, compiled with the greatest attainable accuracy for many years, clearly prove that on the average of years, and, also in each single *successive* year, the mortality is excessive in cities and large towns, as compared with the immediately adjacent country districts under the same climatic conditions. Again, the death rate is never uniform throughout all portions of a city. Those parts which are clean, in which the houses are properly constructed and well ventilated, and where the inhabitants enjoy pure water and wholesome food, exhibit moderate bills of mortality; while on the other hand, those localities in which the streets are narrow and filthy, and where a pauper population lives in cellars and underground rooms, or is crowded together in tenements erected upon ground formed perhaps of the sweepings of streets and market places, where the contents of cess-pools surcharge the porous earth, the death rate is always much higher, especially when to these conditions is added a high summer temperature. Wherever such conditions are met with, sickness must prevail; and thus all physiological processes — growth and development — will become perverted, and if the causes be long continued they will certainly result in physical deterioration. Nor must the rich selfishly conclude that they themselves will not be influenced by those evils which they allow to scourge the poor. *Whatever disturbs to any considerable extent the nutrition* of the body, destroys that harmony which exists between the natural waste constantly going on in it and the assimilative processes by which such losses are repaired, and *must produce* disease. The child continues to grow and develop so long as the nutritive and secretory functions of the mother are maintained, and the harmony of nature is undisturbed. But if from any cause nutrition is impaired, perverted, or interrupted, as it would be by the mammary secretion becoming deteriorated, or the food unsuitable, or if the child be kept in a vitiated atmosphere, or its body not properly protected against changes of temperature, the life processes become perverted or arrested altogether, and vitality so far diminished as to offer but little, if any, resistance to disintegrating action. Whatever therefore interferes with, or

perverts nutrition, lowers the vital powers and lessens resistance to disease, and constitutes what is termed a "*predisposition*" to disease, or it may be *an immediate cause of* disease. This, we conceive, is the only sense in which the term "predisposition to disease" can be properly applied, and it is the only way in which any one is ever predisposed to disease.

The hygienic relations of food is a subject that is supposed to be generally well understood, and yet nothing in our practical every day life presents so many examples of ignorance, and exhibits such flagrant violations of the laws of health. The history of the Irish famine and pestilence of the years 1846 and 1847 developed the dreadful effects of starvation, and fully demonstrated that the want of food in sufficient quantities to nourish the body is not only a predisposing but actually an exciting cause of disease, and may cause the most terrible epidemics.

The quality and also the adaptation of food to the age and condition of the digestive organs exercises a powerful influence in the development of disease. In his treatment of infantile diseases, the medical attendant very seldom inquires further than to assure himself that his little patient is nourished directly by its mother, disregarding or forgetting the fact that the secretion of the mammary glands, both in its quantity and quality, is very greatly and directly influenced by the nervous system, and especially by emotional states. Sir Astley Cooper affirms that " there is evidence that the mammary secretion may acquire an actually poisonous character, under the influence of violent mental excitement." Fits of anger and anxiety of mind diminish the quantity and alter the quality of the milk. Numerous authors might be cited in support of these statements, but the facts are too familiar to require further evidence.

We may further remark that it is also well known, to physicians at least, that the milk carries with it, in a greater or less degree, the peculiar characteristics of food. Exercise, when excessive, diminishes the quantity of butter, and increases the amount of caseine in milk. What then must be the effect upon the child nursed by a mother who is constantly subjected to the harrassing and depressing influence of poverty and its attendant consequences, living perhaps in a damp and vitiated atmosphere, and upon scanty and unwholesome food?

To these causes must be added a bad constitution inherited from parents. There are few biologists who dispute the influence of heredity, not only of ancestral peculiarities, but of disease also. We have sufficient evidence that such a cause does exist, and that it, sooner or later in life, manifests itself as a predisposing influence and diminishes the power of resistance to disease, and perverts the life processes. The physician can do but little for the inheritors of scrofula, syphilis, and other hereditary diseases, and yet it should be understood that even persons thus diseased may outgrow their inherited vitiation of constitution. In the language of Maudsley, " Here, as elsewhere, in nature, like produces like; and the parent who makes himself a temporary lunatic or idiot by his degrading vice, propagates his kind in procreation, and entails on his children the curse of the most hopeless fate."

There is a popular opinion, not confined to the ignorant alone, that as mankind has advanced in a material and intellectual point of view the number of diseases has increased; that many diseases are the necessary accompaniments of mental development, of arts and industry; and that the higher education of youth produces effeminacy, debility, and disease.

Such a view is incorrect, because every onward step in the path of knowledge and true refinement has had a beneficial influence, The sanitary condition of communities improves, *pari passu*, with the education and intelligence of the people composing it. There are, however, some serious errors connected with and growing out of the manner in which we seek to accomplish the grand purposes of civilization. The principles and plans adopted in most of our schools and colleges is at direct variance with those rules of being and of doing which fulfill all that is needful to bodily health and mental vigor. A uniform standard is adopted by teachers, which is usually so high that it is adapted only to the ablest minds, and it therefore has to be attained, by the less gifted, by undue mental effort. Children are generally classified in schools according to their ages or acquirements at the time of their admission, regardless of their mental capacity or physical state. All the children composing a class are supposed to possess the same vigor, and quality of mind, equal powers of application, endurance and adaptability. The powers of mind of some of the pupils are likely in consequence to be overtasked by the constant and severe effort required to keep pace with their classes in the curriculum of studies. From this cause the brain and nervous system become, at first, morbidly excitable, but subsequently, if not relieved by rest and relaxation from study, the memory is weakened, and the power of thought and concentration of the mind proportionately diminished. The physical organs promptly sympathize with, and are speedily brought under the influence of, this depressed nervo-mental state, especially when large numbers of children are in attendance, and kept for hours daily in an improperly heated and badly ventilated school-room.

Both the body and the mind are, in this manner, very often permanently enfeebled, and the nutrition of the body is thus so greatly impaired that growth and development are retarded, perverted, or it may be permanently arrested, and the child is thus doomed to a life of suffering, to terminate, perhaps, in a premature death.

The physiological changes which are effected at the period of puberty, and which result in the perfection of the highest physical powers of animal life — the power of reproduction, characterized as it is by the awakening of new passions, feelings, and aspirations, — has always been considered as particularly dangerous to life, or as rendering the individual especially susceptible to disease. There is much that, in a hasty survey, seems to countenance such an opinion. A more careful examination of the question shows, however, the incorrectness of such an hypothesis. The influences brought to bear and the new conditions developed are apparently different in their character and effects, but they operate in a similar manner and produce the same results (through other parts and organs) as those causes to which reference has already been made as creating diseases among children. The proper recur-

rence of those phenomena associated with ovulation is regarded as evidence of health and vigor of constitution; but if those phenomena be not observed, and the health of the individual subsequently becomes impaired, their non-appearance is considered as the cause. The excess of females over males in the death record (in the census tables), is assigned by physicians to causes having their origin in derangement of the catamenia; while on the other hand, those causes which derange or delay the catamenia are too often overlooked or totally disregarded. The whole of the child-bearing period is almost universally regarded as peculiarly hazardous to female life, and yet we have the authority of Dr. Faar that "the child-bearing women of a population are, in the language of the insurance offices, 'select lives.'" And Dr. Brinton (also of Great Britain), an equally good authority, states that, "apart from a few exceptions, we are bound to remember that all the perils decreed to the female leave her life, as a whole, rather superior to that of the male of corresponding age; in other words, that the pain and danger of child-birth do not bring about an excess of mortality at all approaching that which results from the greater exposure, toil, and intemperance of the stronger sex." These statements are fully corroborated by the experience of life insurance companies in this country and in Europe. According to the last United States census, after the thirty-fifth year the death-rate of the sexes is decidedly in favor of females; and of those from fifty-five to sixty years of age, nearly one third less women die than men.

Deranged menstruation is much more commonly the result than the cause of disease. The fact that consumption causes the death of a larger number of females than of males between the ages of fifteen and thirty-five years is attributed to irregularity and derangements of the catamenial flux. But have we not a more fruitful and common cause in the requirements of society, so often opposed to common sense, and the imperious demands of custom and fashion, which are most fully recognized and followed during this very period? The consequences of ovulation are excessively annoying and inconvenient to fashionable women, as it interferes with their social pleasures and amusements. To obviate these periodical annoyances recourse is often had to ablutions with cold water: the consequence is that the flow from the surcharged and excited organs is suddenly arrested by the contraction of the vessels. The same result is very frequently and unintentionally brought about by unseasonable changes of attire, or by unsuitable clothing. From these causes, so common and so constant, result many of those diseases which are prejudicial to female health, and which so often end in consumption.

The local evils which so certainly follow the causes last cited, are multiform and intricate, as every physician is aware, and yet grave as they may be they do not cease with the individual, for they have a moral as well as a physical effect and bearing upon the community at large.

Of the numerous local effects of the sudden arrest of the catamenial flow, caused by untimely and improper ablutions of cold water, hematocele is the most dangerous. Hematocele may be followed by, or produce, adhesions between the intra-pelvic organs, and of other organs of the abdomen, or of

its muscular walls, producing flexion of the uterus, or narrowing and perhaps obliteration of its canal, and thus become an additional cause of derangement of the uterine functions, — preventing conception, or, if impregnation should take place, the uterus being bound down by the adhesions referred to, its power of expansion becomes limited, the term of utero-gestation cannot be completed, and repeated miscarriages must ensue.

But the most common cause of the excessive death-rate among females, during the period of greatest activity of the reproductive organs, is comprehended in the fact that the largest part of a woman's life is spent *in the house*, or its immediate surroundings, and we should therefore look to the condition of the dwelling for the explanation. The fact is that the mother is subjected to the same conditions — to the same morbific influences — that are largely instrumental in causing a high death-rate among young children, viz.: a vitiated atmosphere, caused by want of drainage, want of sunlight, improper or defective ventilation, etc., etc. The far-reaching ill effects from these causes fall with immense disproportion upon females, and especially upon the poor, the ignorant, and the subordinate.

It generally, indeed almost always, falls to the lot of woman to minister to the wants of the sick, thus exposing her directly to the poisonous exhalations thrown off from the skin and lungs of the diseased; and furthermore, when disease is generated in, or carried into the dwellings of the poor, the time usually given to cleanliness must now be devoted to the care of the sick, and the effects are most likely to manifest themselves in little children and females — the helplessness of the one and the necessities of the other making it impossible for either to escape.

The same conditions produce the same results in males. The reports of the Registrar-general of England show very clearly the influence of occupations upon health and longevity. The deaths of farmers at the age of thirty-five to forty-five years was 9 in 1,000, while that of tailors was 14, of bakers 15, and of butchers 17 in 1,000. The great mortality among butchers is probably due to the effect of the elements of decaying matter by which they are surrounded while engaged at their occupation. M. Lombard exhibits trades in relation to the prevalence of consumption. He has shown that in every one thousand deaths in each of the different occupations noticed, the following proportions were furnished by this disease: —

	DEATHS.
With vegetable and mineral emanations	176
With various dusts	145
With sedentary life	140
With workshop life	138
With hot and dry air	127
With stooping posture	122
With sudden movement of the arms	116
With muscular exercise and active life	89
With exercise of the voice	75
Living in the open air	73

And it may be further stated that the better the condition of life, the less liability to consumption exists. Marc d'Espré has proved that tuberculosis occasions 68 deaths per thousand among the rich, and 223 deaths per thousand among the poor.

THE LONGEVITY OF BRAIN-WORKERS.[1]

By GEORGE M. BEARD, A. M., M. D.,
Of New York.

Thomas Hughes, in his life of "Alfred the Great," makes a statement that "the world's hardest workers and noblest benefactors have rarely been long-lived."

That any intelligent writer of the present day, and especially a writer who, like Mr. Hughes, is a thoughtful student of mental hygiene, should make a statement so absolutely untrue, shows how hard it is to kill an old superstition.

The remark is based on the mischievous theory, which — against the clearest evidence of general observation — has been held for centuries, that the mind can be used only at the injurious expense of the body. This theory has been something more than a mere popular prejudice; it has been a professional dogma, and has inspired nearly all the writers on hygiene since medicine has been a science. On the basis of this theory, intellectual and promising youth have been dissuaded from entering brain-working professions; and thus, much of the choicest genius has been lost to the world; students in college have abandoned plans of life to which their tastes inclined, and gone to the farm or workshop; authors, scientists, and investigators in the several professions have thrown away the accumulated experience of the best half of life, and retired to pursuits as uncongenial as they were profitless. The superstition, for it hardly deserves to be called a theory, has therefore wrought immense evil specifically by depriving the world of the services of some of its best endowed natures, and generally by fostering a habit of accepting statement for demonstration.

Between 1864 and 1866, while preparing a thesis for graduation, I obtained statistics on the general subject of the relation of occupation to health and longevity that convinced me of the error of the accepted teachings in regard to the effect of mental labor. These statistics, which were derived from the registration reports of this country and of England, and from a study of the lives of many prominent brain-workers, were incorporated in an essay on the subject, that was delivered before an Association of Army and Navy Surgeons in New Orleans in 1863, and afterwards published in the "Hours at Home" Magazine. The views I then advocated, and which I enforced by statistical evidence, were: —

1st. That the brain-working classes — clergymen, lawyers, physicians,

[1] The *Science Monthly* having been permitted to publish Dr. Beard's Paper upon "Atmospheric Electricity and Ozone" immediately after it was read before the Public Health Association, the author has been pleased to substitute for it this chapter of more general interest upon "Longevity of Brain-Workers." — E. H.

merchants, scientists and men of letters, — lived very much longer than the muscle-working classes.

2d. That those who followed occupations that called both muscle and brain into exercise, were longer-lived than those who lived in occupations that were purely manual.

3d. That the greatest and hardest brain-workers of history have lived longer on the average than brain-workers of ordinary ability and industry.

4th. That clergymen were longer-lived than any other great class of brain-workers.

5th. That longevity increased very greatly with the advance of civilization; and that this increase was too marked to be explained merely by improved sanitary knowledge.

6th. That although nervous diseases increased with the increase of culture, and although the unequal and excessive excitements and anxieties attendant on mental occupations of a high civilization, were so far both prejudicial to health and longevity, yet these incidental evils were more than counterbalanced by the fact that fatal inflammatory diseases have diminished in frequency and violence in proportion as nervous diseases have increased; and also that brain-work is, *per se*, healthful and conducive to longevity.

Many of these views have since received various and powerful confirmation, and by a number of independent observers.[1] The statistics on this subject I have endeavored to use without abusing them; to draw from them only those lessons that they are really capable of teaching. Among those classes who live mainly by routine and muscular toil (mechanics, artisans, laborers, etc.) change of occupation is the rule rather than the exception, especially in this country; and any statistics of mortality derived from the Registration Reports, are, so far as these classes are concerned, of but little value in the study of the relative effects of the different occupations on health and longevity. Another important complication arises from the fact that certain occupations, as clerkships, positions in factories, teaching, etc., are followed almost exclusively by the young and middle-aged; while other callings, as judgeships, are filled only by those in middle and advanced life. Another difficulty arises from the fact that some important occupations, as journalism, for example, are adopted only by a limited number; and the number in them who annually die is too small to afford any basis for comparison. But this generalization is, I am persuaded, admissible, that the greater majority of those who die in any one of the three great professions — law, theology, and medicine — have, all their lives, from twenty-one upwards, followed that profession in which they died. The converse generalization, that the great majority of those who die in the

[1] Those who desire to obtain the detailed facts on this subject are referred to my Essay in *Hours at Home* (Oct. 1867); to my series of papers on "Hygiene for Students," in the *College Courant* (1869); to my *Home Physician*, p. 380; to Dr. Derby's Registration Reports of Massachusetts and Farr's Registration Reports of England (Supplement to 22d); to Dr. Edward Jarvis's Papers on the "Increase of Human Life," in *Atlantic Monthly* (Oct., Nov., and Dec., 1869); to Dr. Elam's *Physician's Problems;* Hon. B. G. Northrup's *Report of the Connecticut Board of Education* (1869, pp. 61–74); and to the Reports of the Life Insurance Company for Clergymen (Bible House, N. Y.).

muscle-working avocations, have all their lives followed some kind of muscle-working employment, however frequently they may have changed from one to another at different periods, is also true. Very few who once fairly enter theology, medicine, or law ever permanently change to a purely physical calling; and, on the other hand, the number of those who begin life as farmers, laborers, and mechanics, and end it as lawyers, physicians, or clergymen, is quite limited, even in the United States, where every man has a better chance to follow the bent of his genius than in any other country.

A comparison, therefore, of the longevity of the professional and of the muscle-working classes, as derived from Registration reports, such as I have made, is quite justifiable. The value of this comparison would be vitiated if it could be proved that those who enter the professions are originally healthier and stronger, and come from better stock than those who enter physical avocations; but in this country, the practice has been to allow the more delicate members of a family to enter a profession, whilst the tough and hardy work on the farm or learn a trade. Here, as in Europe, there is growing up a distinctively intellectual class who live solely by brain-work; it is, however, not from this class alone, but from the farming, mercantile, and artisan class that the ranks of the professions are filled.

Great Longevity of Great Men. I have ascertained the longevity of five hundred of the greatest men in history. The list I prepared includes a large proportion of the most eminent names in all the departments of thought and activity.

It would be difficult to find more than two or three hundred illustrious poets, philosophers, authors, scientists, lawyers, statesmen, generals, physicians, inventors, musicians, actors, orators, or philanthropists, of world-wide and immortal fame, and whose lives are known in sufficient detail, that are not represented in the list. My list was prepared, not for the average longevity, but in order to determine at what time of life men do their best work. It was, therefore, prepared with absolute impartiality; and includes of course, those who, like Byron, Raphael, Pascal, Mozart, Keats, etc., died comparatively young. Now the average age of those I have mentioned, I found to be 64.20.

The average age at death at the present time, of all classes of those who live over twenty years, is *about fifty.* Therefore, the greatest men of the world have lived longer, on the average, than men of ordinary ability in the different occupations by fourteen years; six years longer than physicians and lawyers; nineteen or twenty years longer than mechanics and day laborers; from two to three years longer than farmers; and a fraction of a year longer than clergymen, who are the longest-lived class in our modern society. The value of this comparison is enforced by the consideration that longevity has increased with the progress of civilization, while the list I prepared represents every age of recorded history. A few years since I arranged a select list of one hundred names, comprising the most eminent personages, and found that the average longevity was *over seventy years.* Such an investigation any one can pursue; and I am sure that any chronology, comprising from one to five hundred of the most eminent per-

sonages in history, at any cycle, will furnish an average longevity of from sixty-four to seventy years. Madden, in his very interesting work, "The Infirmities of Genius," gives a list of two hundred and forty illustrious names, with their ages at death. The average I found to be sixty-six and a fraction.

In view of these facts, it may be regarded as established that "the world's hardest workers and noblest benefactors" have usually been very long-lived.

CAUSES OF THE GREAT LONGEVITY OF BRAIN-WORKERS.

The full explanation of the superior longevity of the brain-working classes, would require a treatise on the science of sociology, and particularly of the relation of civilization to health. The leading factors, accounting for the long life of those who live by brain-labor, are as follows: —

1. *The inherent and essential healthfulness of brain-work.* To work is to grow; and growth, except it be forced, is always healthful. It is as much the function of the brain to cerebrate, as of the stomach to digest; and cerebration, like digestion, is normal, physiological, and healthful. In all organizations of force, the exercise of force develops more force; work evolves strength for work. A plant that is suffered to bud and bloom, is more sturdy and longer lived than the plant that is kept from the light, or trimmed of all its blossoms. By thinking, we gain the power to think; functional activity, within limits, tends to vigor and the self-preservation of an organ, and of the body to which the organ belongs. The world has been taught that the brain can be developed only at the expense of the other organs of the body; granting that brain-work strengthens the brain itself, the rest of the body is impoverished thereby — hence disease, and early death. But recent investigations in cerebro-physiology, seem to indicate that the centres of thought in the anterior region of the brain, are also the centres of muscular motion; and hence it may perhaps be inferred that to develop the brain may be one method of developing the muscles.[1] It is certain that the brain-working classes are, on the average, well developed muscularly; and in size and weight are superior to the purely muscle-working classes.

2. *Brain-workers have less worry, and more comfort and happiness than muscle-workers.* Worry is the converse of work; the one develops force, the other checks its development, and wastes what already exists. Work is growth; worry is interference with growth. Worry is to work what the chafing of a plant against the walls of a greenhouse is to limitless expansion in the free air. In the successful brain-worker, worry is transferred into work; in the muscle-worker, work too often degrades into worry. Brain-work is the highest of all antidotes to worry; and the brain-working

[1] I here refer to the experiments of Hitzig, of Berlin, in the electrical irritation of the brains of living animals. These experiments have been confirmed by a variety of experiments undertaken by Ferrier, of London, by myself, and other observers. I use the word centre, in an experimental sense; and the above theory of the relation and definition of the thought centres, and muscle centres, is merely a provisional suggestion. (See *Archives of Electrology and Neurology*, May, 1874, for a record of my own experiments, with remarks, and also a general resume of facts.)

classes are therefore less distressed about many things, less apprehensive of indefinite evil, and less disposed to magnify minute trials, than those who live by the labor of the hands. To the happy brain-worker, life is a long vacation; while the muscle-worker often finds no joy in his daily toil, and very little in the intervals. Scientists, physicians, lawyers, clergymen, orators, statesmen, literati, and merchants, when successful, are happy in their work, without reference to the reward; and continue to work in their special callings long after the necessity has ceased. Where is the hod carrier, that finds joy in going up and down a ladder; and, from the foundation of the globe until now, how many have been known to persist in ditch-digging, or sewer-laying, or in any mechanical or manual calling whatsoever, after the attainment of independence? Good fortune gives good health. Nearly all the money of the world is in the hands of brain-workers; to many, in moderate amounts, it is essential to life, and in large or comfortable amount it favors long life. Longevity is the daughter of luxury. Of the many elements that make up happiness, mental organization, physical health, fancy, friends [1] and money — the last is, for the average man, greater than any other, except the first. Loss of money costs more lives than the loss of friends, for it is easier to find a friend than a fortune. Almost all muscle-workers are born, live, and die poor. To live on the slippery path that lies between extreme poverty on one side, and the gulf of starvation on the other; to take continual thought of to-morrow, without any good result of such thought; to feel each anxious hour that the dreary treadmill by which we secure the means of sustenance for a hungry household may, without warning, be closed by any number of forces, over which one has no control, to double and triple all the horrors of want and pain, by anticipation and rumination, — such is the life of the muscle-working classes of modern civilized society; and when we add to this the cankering annoyance that arises from the envying of the fortunate brain-worker who lives in ease before his eyes, we marvel not that he dies young, but rather that he lives at all.[2]

3. *Brain-workers live under better sanitary conditions than muscle-workers.* They have better food and drink, warmer clothing, breathe purer air, and are less exposed to fatal accident and the poison of disease. None of the occupations are ideal; none fulfill all the laws of health; but the muscle-working callings are all more or less unhealthy; tradesmen, artisans, common laborers, and even farmers (who combine muscle with brain-work), all, are forced to violate sanitary law, every hour of their lives; not one out of ten have enough good food; many are driven by passion and hunger to excess in the worst forms of alcoholic liquors; for a large number, sleep is a luxury of which they never have sufficient for real recuperation; healthful

[1] I do not here refer to accumulated wealth exclusively, but to income or sufficient amount to purchase comforts and luxuries. Many persons (and notably successful professional men), live out their days in comfort and luxury, although they never succeed in accumulating fortunes; to them, their reputation is wealth and capital.

[2] Those who question the truth of the above picture, are referred to any of the recently published essays and treatises on the condition of the peasantry of England. Observations show, that in our own country, not only in large cities, but in all manufacturing towns, and even in farming districts, the laboring classes are as badly circumstanced as I have stated.

air is but rarely breathed by the laboring classes of any large city; exposure to weather, that brings on fatal inflammatory diseases; accidents that cripple or kill — in all these respects, the muscle-worker, as compared with the brain-worker, is at stupendous disadvantage.

4. *The nervous temperament, which usually predominates in brain-workers, is antagonistic to fatal, acute, inflammatory disease, and favorable to long life.* Comparative statistics have shown, that those in whom the nervous temperament prevails, live longer than those in whom any one of the other temperaments prevail, and common observation confirms the statement. Nervous people, if not too feeble, may die every day. They live, but they do not die; they talk of death, and each day expect it, and yet they live. Many of the most annoying nervous diseases, especially of the functional, and some even of the structural varieties, do not rapidly destroy life, and are indeed consistent with great longevity. I have known a number of men and women who were nervous invalids for half a century or more, and died at an advanced age. It is one of the compensations of nervousness that it protects the system against those febrile and inflammatory diseases that are so rapidly fatal to the sanguine and the phlegmatic. The nervous man can expose himself to malaria, to cold and dampness, with less danger of disease, and with less danger of death if he should contract disease, than his tough and hardy brother. This was shown in the late war, when delicate, ensanguined youth, followed by the fears of friends, went forth to camp and battle, and not only survived, but grew stout amid exposures that prostrated by thousands the lumbermen of Maine, and the sons of the plough and the anvil. In the conflict with fevers and inflammations, strength is often weakness, and weakness becomes strength — we are saved through debility. Still further, my studies have shown that, of distinctively nervous diseases, those which have the worst pathology and are the most hopeless, such as locomotor ataxia, progressive muscular atrophy, apoplexy with hemiplegia, and so on, are more common and more severe, and more fatal among the comparatively strong and tough, than among the most delicate and finely organized.[1] Cancer, even, goes hardest with the hardy, and is most relievable in the nervous.

5. *Brain-workers can adapt their labor to their moods and hours and periods of greatest capacity for labor, better than muscle-workers.* In nearly all intellectual employments there is large liberty; literary and professional men especially, are so far masters of their time that they can select the hours and days for their most exacting and important work; and when from any cause indisposed to hard thinking, can rest and recreate, or limit themselves to mechanical details. Thus, there is less of the dreadful in their lives; they work when work is easy, when the desire and the power are in harmony; and, unlike their less fortunate brother in the mill or shop, or diggings, need not waste their force in urging themselves to work. Forced labor, against the grain of one's nature, is always as expensive as it is unsatisfactory; it tells on the health and on life. Even coarser natures have

[1] In my paper on "Spinal Congestion and Locomotor Ataxia," in the *Philadelphia Medical Times* for January 24 and 31, 1874, I have discussed this point in some detail.

their moods, and the choicest spirits are governed by them; and they who worship their moods do most wisely; and those who are able to do so, are the fortunate ones of the earth.

Again, brain-workers do their best work between the ages of twenty-five and forty-five; before that period they are preparing to work; after that period, work, however extensive it may be, becomes largely a matter of routine. Lawyers and physicians do much of their practice after forty; but to practice is easy, to learn is hard — and the learning is done before forty or forty-five. In all directions, the French motto holds true: "It is the first step that costs." Successful merchants lay the foundations of fortune in youth and middle life, to accumulate, and recreate, and take one's ease in old age; thus they make the most when they are doing the least, and only become rich after they have ceased trying to be so.[1]

With muscle-workers, there is but little accumulation, and only a limited increase of reward; and in old age, after their strength has begun to decline, they must, with increasing expense, work even harder than before.

To this should be added the consideration that manual employments cost as much force after they are learned as before; they can never, like many intellectual callings, become so far forth matters of routine as to require little effort. It is as hard to lay a stone wall after one has been laying it fifty years, as during the first year. The range of muscular growth and development is narrow, compared with the range of mental growth; the day-laborer soon reaches the maximum of his strength. The literary or scientific worker goes on from strength to strength, until what at twenty-five was impossible, and at thirty difficult, at thirty-five becomes easy, and at forty a pastime; and besides he has the satisfaction that the work done so easily at thirty-five and forty is incomparably better than the work done with so much difficulty at twenty-five.

6. *Comparative Longevity of the Professions.* Inasmuch as professional men do not usually change their callings, but die in the special profession in which they have lived, the vital statistics, at least of lawyers, physicians, and clergymen, become of value in determining their comparative longevity. I found in my researches made several years ago, that lawyers and physicians lived to be about fifty-seven or fifty-eight. The difference in the longevity of lawyers and physicians is but trifling. My observations in this respect have been variously confirmed by other statiscians.[2]

[1] The whole subject of, "The Relation of Age to Work," I have discussed in my pamphlet on *Legal Responsibility in Old Age*, to which I may refer those who are interested in the subject. What is there written, is preliminary to an exhaustive treatise now in the course of preparation.

[2] "An investigation made by a Berlin physician into the facts and data relating to human longevity shows the average age of clergymen to be 65; of merchants, 62; clerks and farmers, 61; military men, 59; lawyers, 58; artists, 57; and medical men, 56. Statistics are given showing that medical men in England stand high in the scale of longevity. Thus, the united ages of twenty-eight physicians who died there last year, amount to 2,354 years, giving an average of more than 84 years to each. The youngest of the number was 80; the oldest, 93; two others were 92 and 89, respectively; three were 87, and four were 86 each; and there were also more than fifty who averaged from 74 to 75 years."

LONGEVITY OF THE PRECOCIOUS.

That precocity predicts short life, and is therefore a symptom greatly to be feared by parents, has, I believe, never been questioned. In poetry and in science, the idea has been variously incorporated that early brilliancy is a sure indication of a feeble constitution and an early death. This view is apparently sustained by analogy, and by facts of observation. Plants that are soon to bloom are soon to fade; those which grow slowly live long and decline slowly. Observing these facts, we naturally adhere to the opinion that the same principle should hold good as regards men, but in making the analogy we forget that it loses its force, unless the objects implicated start in life with the same potential force and are surrounded by the same external conditions. It is probable that, of two individuals with precisely similar organizations and under similar circumstances, the one that develops earlier will be the first to die; but we are not born equally endowed and similarly circumstanced. Not only are men unlike in organization, but they are very widely unlike; between the brain of Shakspeare and the brain of an idiot is a measureless gulf, and we may believe that difference of degrees may be found between the greatest and simply great men. We may believe that some are born with far more potential nervous force than others. They are millionaires in intellect as well as in money, who can afford to expend enormous means without becoming impoverished. An outlay of one hundred dollars may ruin the mechanic, working for his daily wages, while the royal merchant may spend a thousand, and barely know it. There are those who can begin their life-work earlier, toil harder and longer, than the average, and yet attain a very great age. The average age of 500 illustrious men, including those who did not exhibit any special precocity, was about 64.20. Of these 500 individuals, among whom there were twenty-five women, 150 were decidedly precocious, and their average age was 66.50, or more than two years higher than that of the list of 500, that included the precocious and non-precocious. So far as I could ascertain, the instances of extraordinary longevity were as great among the precocious as among those who were not.[1] My investigations in this department fully confirm the remark of Wieland, that "an almost irresistible impulse to the art in which they are destined to excel manifests itself in future virtuosi — in poets, painters, etc., from their earliest youth."

Not only in poetry and painting, but also in philosophy, in science, and in invention — indeed, in every great department in which human nature has displayed itself, it is true, as Milton beautifully remarks, "Childhood shows the man, as morning shows the day."

Madder, in his "Infirmities of Genius," says, that "Johnson is indeed of

[1] A contributor to the *Galaxy* for August (G. W. Winterburn) thus discourses concerning musical prodigies. Investigating the records of the past two centuries, he finds 213 recorded cases of acknowledged prodigies. None of them died before their fifteenth year, some attained the age of 103 — and the average duration of life was 58 — showing that, with all their abnormal precocity, they exceeded the ordinary longevity by about six per cent. Those who died before the age of 21 were, without exception, musicians of the very highest order.

the opinion that the early years of distinguished men, when minutely traced, furnish evidence of the same vigor or originality of mind by which they are celebrated in after-life."

The more closely I study biography, the more strongly I become convinced that the number of really illustrious geniuses who did not give early manifestations of their genius is very limited. I do not forget that some of the currently reported exceptions are very striking. Thus we are told that Chalmers at school was stupid and mischievous; that Adam Clarke, as a boy, could do nothing but roll huge stones about; that of Sir Walter Scott, his teacher, Professor Dalzell, frankly said: "Dunce he was and dunce he would remain;" that Burns, though a good athlete, showed, in his boyhood, no unusual gifts; that Goldsmith was "a plant that flowered late;" that John Howard, and Napoleon, and Wellington were, to say the least, but little remarkable at school; and that the father of Isaac Barrow is reported to have said that "if it pleased God to take away any of his sons, he prayed that it might be his son Isaac, as being the least promising of them all."

These exceptions, apparent and real, may be explained in two ways:—

1st. The stupidity attributed to men of genius may be really the stupidity of their parents, guardians, and biographers.

Men are precocious, if they are precocious at all, in the line of their genius. It is observed, as Wieland has stated, that almost all artists and musicians are recorded as precocious, the exceptions being very rare. Music and drawing appeal to the senses, attract attention, and are therefore appreciated, or at least observed by the most stupid parents, and noted even in the most superficial biographies. Philosophic and scientific thought, on the contrary, does not at once, perhaps may never, reveal itself to the senses,—it is locked up in the cerebral cells. In the brain of that dull, pale youth, who is kicked for his stupidity and laughed at for his absent-mindedness, grand thoughts may be silently growing; the plant which to-day looks stunted and dwarfed may hereafter quicken into life, rise into strength and beauty,—to give fruit and shade to many generations. Scott, for example, though he stood low in his class at school, yet very early exhibited genius as an inventor and narrator of "tales of knight-erranty, and battle, and enchantments."

Newton, according to his own account, was very inattentive to his studies and low in his class, but a great adept at kite flying, with paper lanterns attached to them, to terrify the country people, of a dark night, with the appearance of comets; and when sent to market with the produce of his mother's farm, was apt to neglect his business, and to ruminate at an inn over the laws of Kepler.

It is fair to infer that the stupidity attributed to many other distinguished geniuses may be similarly explained. This belief is enforced by the consideration that many, perhaps the majority, of the greatest thinkers of the world seemed dull, inane, and stupid to their neighbors, not only in childhood but through their whole lives. The brains as well as the muscles of men differ in the times of their growth. Of a dozen individuals of the same endowments and external conditions, some will ripen early, others late.

This is observed in colleges, where some who take the lead in everything make no farther progress in after life. They "strike twelve the first time." Others who, between fifteen and twenty-five are dullards, between twenty-five and forty develop great powers.

It is probable, however, that nearly all cases of apparent stupidity, in young geniuses, are to be explained by the want of circumstances favorable to the display of their peculiar powers, or to a lack of appreciation or discernment on the part of their friends. It is very difficult to find any college graduate of remarkable ability who did not, during his collegiate course, in some way manifest the germs of that ability, but there are many who fail in the prescribed routine of studies in the race for literary honors, who yet, in some department or other, do attain distinction. As compared with the world, the most liberal curriculum is narrow; to one avenue of distinction that college opens, the world opens ten. In order to learn the material of which a college class is made, it is necessary not only to look at the marks on the tutor's book and scan the prize list of the societies, but also to go out on the ball ground and down the river — we must mingle in the evening carousal and study the social life of the students in their rooms, or their walks, and in vacation.

Whether we regard those general considerations or not, the statistical fact remains that, in spite of the incompleteness of biographies, and the ignorance of parents and teachers, *a very considerable proportion of the greatest geniuses of the world are known to have been as remarkable in their precocity as in their genius; and in spite of this precocity were exceedingly long-lived.*

Great precocity, like great genius, is rare. Although I have known but few children whom fond parents did not at some time believe to be more or less superior to the average, yet I do not remember that I ever saw a very precocious child. There is in some children a petty and morbid *smartness* that is sometimes mistaken for precocity, but which in truth does not deserve that distinction.

The manifestation of genius in childhood is as normal and as healthful as its manifestation in maturity; but in childhood, as in extreme old age, the effects of overtaxing the powers are more severely felt than in maturity. Petty smartness is oftentimes a morbid symptom; it comes from a diseased brain, or from a brain in which a grave predisposition to disease exists. Such children may die young, whether they do or do not early exhibit unusual quickness.

The morbidly precocious soon wear themselves out, early find their level, and in after life are stupid or ordinary; the normally physiologically precocious go on from strength to strength, and do not reach their maximum until between thirty and forty; and live longer and are capable of working harder than those of average gifts. There have been noted and oft-quoted instances where the precocious geniuses have died in early manhood, or just at reaching the maximum of their strength between thirty and forty. The names of Pascal, Mozart, Keats, will be at once recalled. But we forget the infinite number who have died at the same age or earlier, and of the same diseases; but who neither in childhood nor in manhood exhibited any supe-

rior genius. The only method of arriving at the truth on the question is the one I have adopted; that is, to obtain the average longevity of a large number, who were known to have been greatly precocious, and compare it with the average longevity of other able men in the same departments.

Those who have not given special thought to this theme will be surprised to learn how early and how strikingly the genius of some of the greatest and longest-lived heroes was displayed. Leibnitz, at twelve, understood Latin authors well, and wrote a remarkable production. Gassendi, "the little doctor," preached at four; and at ten wrote an important discourse. Goethe, before ten, wrote in several languages. Meyerbeer, at five, played remarkably well on the piano. Niebuhr, at seven, was a prodigy; and at twelve had mastered eighteen languages. Michael Angelo at nineteen had attained a very high reputation. At twenty Calvin was a fully-fledged reformer, and at twenty-four published great works on Theology that have changed the destiny of the world. Jonathan Edwards, at ten, wrote a paper refuting the materiality of the soul; and at twelve was so amazingly precocious that it was predicted of him that he would become another Aristotle. At twenty Melancthon was so learned that Erasmus exclaimed: "My God! What expectations does not Philip Melancthon create!"

CAUSES OF THE EXCEPTIONAL LONGEVITY OF GREAT BRAIN-WORKERS.

The explanation of the surprising longevity of great brain-workers is quite complex. The readiest answer to the problem would be that brain-work is healthful; and that, therefore, the better the brain and the harder it is worked, the longer the life of its possessor. Such a solution would not be entirely true; and if it were true unqualifiedly, it would clear up but one side of the question.

The answer is to be found, not in any single consideration, but in many, as follows: —

1. *Great men usually come from healthy, long-lived ancestors.* Longevity is a correlated inheritance of genius. In order that a great man shall appear, a double line of tough, more or less vigorous fathers and mothers must fight in the struggle for existence and come out triumphant. However feeble the genius may be, his parents or grandparents are usually strong; or if not strong, are long-lived. Great men may have nervous if not insane relatives; but the nervous temperament holds on to life longer than any other temperament. The great man may himself be incapable of producing other great men; in him indeed the branch of the *race* to which he belongs may reach its consummation, but the stock out of which he is evolved must be strong, and usually contains latent if not active genius.[1] Longevity is, of course, hereditary, like all qualities or tendencies of organized life; and if great men come from long-lived stock, this fact is one most potent explanation of their exceptional longevity.

2. *A good constitution usually accompanies a good brain.* The cerebral and

[1] That intellectual qualities are subject to all the laws of hereditary descent, so far as we know these laws, has been fully established by the researches of Galton in England, and of myself in this country. I therefore assume the fact without argument.

muscular forces are correlated. This view, though hostile to the popular faith, is yet sound and supportable. A large and powerful brain in a small and feeble body is a monstrosity. "In monstrosities Nature reveals her secrets," says Goethe. When a specially small and delicate frame sustains a specially large and potent brain, men wonder, as at a tree bowed to the earth by the weight of its over-abundant fruit. Everywhere Nature is a slave to the necessity of correlation or correspondence of parts and organs with each other; and unless she heeds it, all organized life would become awry and misshapen. In all the animal realm, there is a general though not unvarying relation between the brain and the body of which it is a part and to which it ministers. An hundred great geniuses, chosen by chance, will be larger than a hundred dunces anywhere — will be broader, taller, and more weighty. In all lands, savage, semi-civilized, and enlightened, — the ruling orders, chiefs, sheiks, princes by might and mind, scientists, authors, orators and great merchants, weigh more than the slaves, peasants, and riff-raff over whom they rule; and bear the evidences of their superiority so clearly that they need no other insignia. In any band of workmen on a railway, you shall pick out the "boss," by his size alone; and be right four times out of five. Those monstrosities where genius is cabined in a small body, show the law by their very rarity.

3. *Great men who are permanently successful have correspondingly greater will than common men; and force of will is a potent element in determining longevity.* The one requisite for great success is "*grit;*" and, more uniformly than any other single quality or combination of qualities, it is found in those who attain high distinction. In the grand struggle for existence it is everywhere the stiff upper lip that conquers; the timid and the yielding are cowed and crushed, and over them rise the courageous and the strong. In certain special lines, as poetry and art, extraordinary gifts may, as it were, draw their possessor into fame with but little effort of his own; but the highest seats in the temples both of art and poetry are given only to those who have earned them by the excellence that comes from *consecutive effort*, which everywhere tests the vital power of the man. That longevity depends not a little on the will, no one will dispute. The whole subject of the relation of mental character to longevity is one of vast interest, and is too far-reaching to be here discussed; but this single point must be granted without argument, that of two men every way alike and similarly circumstanced, the one who has the greater courage and grit will be the longer-lived. One does not need to practice medicine long to learn that men die that might just as well live if they resolved to live; and that myriads who are invalids could become strong if they had the native or acquired will to vow that they would do so. Those who have no other quality favorable to life, whose bodily organs are nearly all diseased, to whom each day is a day of pain, who are beset by life-shortening influences, yet do live by grit alone. Races and the sexes illustrate this. The pluck of the Anglo-Saxon is shown as much on the sick-bed as in Wall Street or on the battle-field. During the late war I had chances enough to see how thoroughly the black man wilted under light sickness, and was slain by disease, over which his white

brother would have easily triumphed. When the negro feels the hand of disease pressing upon him, however gently, all his spirit leaves him. The great men of history are as much superior in their will-power to the average of their fellows, as are the races to which they belong to the inferior and uncivilized races. They live, for the same reason that they become famous. They obtain fame because they will not be obscure; they live because they will not die.

4. *Great men work more easily than ordinary men.* Their expenditure of force to accomplish great things is less plenteous than the expenditure of ordinary men to accomplish such things. A Liverpool draft-horse draws with ease a load at which a delicate racer might tug and strain without moving it. Ruskin is quite right when he says that the greatest work is done easily. The best action is the unconscious. It is the essence of genius to be automatic and spontaneous. The common mind cannot attain this spontaneity, or at any rate, only to a slight degree. Many a huckster or corner tradesman expends each day more force on work or worry than a Stewart or a Vanderbilt. It is notorious that Beecher's great sermons cost him only an hour's musing or so, while many country pastors work for a week over "efforts" that suggest no thought, except pity for the composer. Great genius is usually industrious, for it is its nature to be active; but its movements are easy, spontaneous, joyous. There are probably many school-boys who have exhausted themselves more over a prize composition than Shakespeare over "Hamlet," or Milton over the choicest passages in "Paradise Lost." At one time I acted as surgeon on a gunboat of the United States Navy on the blockade, which was under the command of a man who, I am sure, worried and exhausted himself more over that little craft than did Admiral Farragut over the entire squadron. When he died, shortly after the close of the war, I was requested by his widow to use my influence in procuring a pension for her. This I was able to do most conscientiously, for I knew that he had worn himself out in the service, although the vessel under his charge, while I was on board at least, never went into action, chased no blockade runner, and experienced not one moment of real peril.

5. *The advantages that belong to the brain-working orders in general.* Of these I have already spoken in some detail. The great brain-workers of the world have not all been rich; neither have they all been poor; some of them have lived a portion of their lives, but very few all their lives, in extreme want; and the majority have been most of the time surrounded with at least moderate comforts.

CAUSES OF THE GREAT LONGEVITY OF CLERGYMEN.

When, in 1867, I first called attention to the fact that clergymen were longer-lived than any other class of brain-workers, serious doubt was expressed whether there might not be some error in my statistics. So much had been said of the pernicious effects of mental labor, of the ill-health of brain-workers of all classes, and especially of clergymen, that very few were prepared to accept the statement that the clergy of this country and of England lived longer than any other class, except farmers, and very

naturally suspected a lurking fallacy. Other observers, who have since given special attention to the subject, have more than confirmed this conclusion, and have shown that clergymen are longer-lived than farmers.

The Rev. Josiah F. Tuttle, D. D., President of Wabash College, Indiana, has ascertained the ages of 2,442 clergymen — 600 Trinitarian Congregationalists, 317 Presbyterians, 231 Episcopalians, 268 Baptists, 208 Methodists, 166 Unitarians, etc., — and found that the average was "a little over 61 years." "Considerably over one half of the whole were over 60 years of age at their death; three fourths of the whole were over 50 years old at death; and seven eighths of the whole were over 40 years of age at death." Dr. Tuttle found that the average age at death of 408 individuals (not clergymen), and who had died over 21 years of age, was a little over 51 years. This result pretty nearly corresponds with mine.

But by far the more thorough investigation on this subject, and one that must fully settle the question for all minds over whom facts have any influence, has been recently made by Rev. J. M. Sherwood, formerly editor of "Hours at Home," and now Secretary of the "Society for Promoting Life Insurance among Clergymen." This gentleman has labored long and patiently in this department, and has ascertained that the average age of our ministers at death is sixty-four. The report (I quote from Document No. 3 of the Society) states: "this is four years more than the longevity of the most favored (?) class; ten years more than in the other professions: and from twelve to nineteen years above that of mechanics, artisans, miners, operatives, and the like."

These conclusions differ slightly from mine, but the difference is in favor of clergymen. Mr. Sherwood informs me that he had obtained the average from a list of ten thousand clergymen, whose ages at death he ascertained at great labor by consulting "the minutes of ecclesiastical bodies for thirty years past, the catalogues of theological seminaries, Wilson's 'Historical Almanac,' Dr. Sprague's 'Annals of the American Pulpit,' biographical dictionaries, the files of religious journals, etc."

A list of ten thousand is sufficient and more than sufficient for a generalization; for the second five thousand did nothing more than confirm the result obtained by the first. It is fair and necessary to infer that if the list were extended to ten, twenty, or even one hundred thousand, the average would be found about the same.

In England, also, clergymen live to a greater age than any other class. According to the report of the Secretary of the Clerical Mutual Life Assurance Society, the mortality is less than that in twenty other companies by a very important percentage.

CAUSES OF THE EXCEPTIONAL LONGEVITY OF CLERGYMEN.

The reasons why clergymen are longer-lived than any other class of brain-workers are these: —

1. *Their callings admit of a wide variety of toil.* — In their manifold duties their whole nature is exercised — not only brain and muscle in general, but all, or nearly all, the faculties of the brain — the religious,

moral, and emotional nature, as well as the reason. Public speaking, when not carried to the extreme of exhaustion, is the best form of gymnastics that is known; it exercises every inch of a man, from the highest regions of the brain to the smallest muscle. In his public ministrations, in his pastoral calls, in his study, in his business arrangements, in his general reading, the pastor exercises more widely and variously than any other calling.

2. *Comparative freedom from financial anxiety.* — The average income of the clergymen of the leading denominations of this country in active service as pastors of churches (including salary, house rent, wedding fees, donations, etc.), is between $800 and $1,000, which is probable not very much smaller than the net income of all other professional classes. Further, the income of clergymen in active service is collected and paid with greater certainty and regularity, and less labor of collection on their part than the income of any other class except government officials. Then, again, their income, whether small or great, comes at once, as soon as they enter their profession, and is not, as with other callings, built up by slow growth.

Worry is the one great shortener of life under civilization; and of all forms of worry, financial is the most frequent, and for ordinary minds, the most distressing. Merchants now make, always have made, and probably always will make, most of the money of the world; but business is attended with so much risk and uncertainty, and consequent worry, that merchants die sooner than clergymen, and several years sooner than physicians and lawyers.

By what I here say, I do not mean to give the impression that clergymen are properly paid; for it is thoroughly true, as was once remarked by a certain political economist: "We pay best, — 1st. Those who destroy us — *generals*. 2d. Those who cheat us — *politicians and quacks*. 3d. Those who amuse us — *actors and singers;* and least of all, those who instruct us."

The average income of all classes in this country is small — about $700 a year — and for the laboring classes not more than half that sum; and if the same efforts were made to obtain the details of the financial history of every family in the land, as has been done in the case of clergymen, there would be some very dreary reading.

3. *Their superior mental endowments.* — The law which I derive from the study of vital statistics is, that other conditions being the same, the greater and richer the brain, the greater the longevity.

Now I speak calmly and discriminately, and from a careful comparison of biographical data, when I say that the clergymen of this country — as represented by the Congregational, Presbyterian, and Unitarian denominations — have presented a higher average of the higher kinds of ability than any other equally large class, of any age or section, of recorded history.

During the past fifteen years, there has been a tendency which is now rapidly increasing, for the best endowed and best cultured minds of our colleges to enter other professions, and the ministry has been losing while medicine, business, and science, have been gaining.

4. *Their superior temperance and morality.* — Clergymen are more regular

in their sleep, meals, and exercise, than any other intellectual class; and are less exposed to injurious influences and contagious diseases than some other occupations. Very rarely, indeed, does a clergyman become grossly intemperate, or addicted to gambling, or to the exclusive and injurious pursuit of any animal pleasures.[1]

[1] Against the statements in regard to the superior morality of clergymen, I must, of course, make the concession that they are occasionally found guilty of sexual irregularities. The number of clergymen, more or less prominent, who, within my own knowledge have been convicted of serious sins in this direction, is quite large; and it is, at first thought, a puzzling fact in psychology, that those who are so upright in other respects should so often yield to the temptations that come through the sexual appetite. My explanation is that clergymen live largely in a world of emotion, and the emotions excite and stimulate each other. Even the noblest and holiest feelings are liable to arouse the lowest animal passions. Religious insanity often accompanies sexual insanity; and in our asylums, those who talk wildly of Jesus Christ frequently need strait-jackets to keep them from self-abuse. Among the sane and the healthy, benevolence, large-heartedness, and sincere piety, even, may, in a nature not fitly balanced by strong reason and will, open the doors of sexual vice.

Those tender, confiding, spiritual recluses who thus fall into sin are called hypocrites, — when, had they been insincere, they would not have sinned, for they would have been less tempted; their faith is their ruin; they fall through their very virtues.

Physicians are far more tempted than clergymen, and are in other respects not so moral; but they rarely disturb the peace of families.

THE GERM THEORY OF DISEASE AND ITS RELATIONS TO HYGIENE.

By F. A. P. BARNARD, LL. D., of New York,

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No more striking evidence can be adduced of the intellectual advancement characteristic of modern times, than the general recognition among men of the universal reign of law. It is true that this general recognition has not yet become quite universal. There are not wanting many, even in our enlightened age, to whom the advent of a comet still brings feelings of dismay, and in whose belief the wind literally bloweth where it listeth, every day. The belief in lucky and unlucky days has by no means disappeared, and among even the well educated there are yet some who would not willingly put to sea on the brightest Friday morning that ever shone. It is difficult to disabuse the mind of impressions which almost inevitably find a place there in the infancy of individuals and of peoples. Every event of which the causes are obscure, is naturally attributed by the ignorant or inexperienced, either to blind chance or to the purposed interference of some supernatural power; and such is the strength of the imagination that the feeling often survives long after reason has exploded the error.

There is no class of natural phenomena which the men of all times have been disposed to look upon as being more completely exempt from the dominion of law, than those which concern sickness and health. The illness of an individual appears always to have been esteemed an event entirely fortuitous, which no human prescience could anticipate, and no human precaution could avert; and the simultaneous sickening and death of multitudes has more frequently been regarded as an evidence of Divine displeasure, directly interfering with the usual order of nature, than as a grave and interesting phenomenon to be patiently investigated and rationally explained. The truth is, nevertheless, that the laws of health and of disease in living organisms are as fixed and invariable as, in abstract science, are those of mathematics. The difference lies in the greater difficulty of their discovery. This is well illustrated in the history of the subject which I have ventured, with a presumption which in this presence may seem like temerity, to select as the theme of my remarks this evening.

The germ theory of disease is not, as is commonly supposed, a theory which has originated in very recent years. More than two hundred years ago it was brought forward, at least as an hypothesis, by the celebrated Father Kircher, in his "Scrutinium Physico-Medicum contagiosæ luis quæ pestis dicitur," to account for the infectious propagation of the plague. How-

ever plausible this theory might at that time have seemed, it could then, nevertheless, claim no higher rank than that of a bare hypothesis; and it has only been in times comparatively recent that observation has brought to light a sufficient number of facts apparently favoring it to justify our advancing it in the arena of scientific discussion to the higher dignity of a theory.

GENERAL PRINCIPLES BEARING ON THE SUBJECT.

Before proceeding to consider the evidences bearing on the truth of this theory, for or against, a few observations of a general nature may properly here find place. No living organism enjoys an existence of unlimited duration. Every such organism, under favorable circumstances, passes through three distinct stages, which are those of growth, vigorous maturity, and decline. The organism commences as a germ, and ends in dissolution and disintegration. Since the laws of life, as well as those of physics, are fixed and definite, there is reason to believe that all organisms of the same species, if placed in conditions equally favorable to their development, would be equally long-lived; yet, in point of fact, those which pass through the regular stages constituting their normal life are comparatively few. In the large majority, the vital functions are, earlier or later, more or less disturbed, if not arrested, by an endless variety of causes tending to produce disease and premature death. In the human race life is often shortened by ignorant or willful disregard of the conditions necessary to the preservation of health. Accident, also, often exposes individuals to deleterious influences. Thus, in many cases, diseases arise from exposure to extremes of temperature, or from excesses in eating and drinking, persisted in until the organs of digestion become debilitated and fail to fulfill their proper functions. But besides these causes of disease, which may be classed under the head of "injurious conditions," there are other influences directly morbific, which, whenever they come into play, cut short the duration of life. Poisons belong to this class, but the effects of these are felt only in occasional and accidental instances. Other noxious influences, of which the pernicious consequences are more widely spread, are those which produce the diseases called zymotic. Such are malaria, contagion, and infection, instrumentalities to which are owing the wide-spread ravages of epidemics.

It may be remarked that there are many cases of disease in which the cause is not traceable directly to any of the sources above mentioned, but in which the disease has been transmitted by inheritance from a parent similarly affected. In such cases there is nevertheless every reason to believe that the disease in its first appearance was produced in a healthy organism by causes belonging to one or the other of the classes above named.

The diseases which it is the object of the present paper to consider, are only those which belong to the epidemic or contagious class.

THEORIES OF CONTAGION.

No subject has occupied more the careful attention of physicians, or has been a subject of more elaborate observation and experiment, or has led to more marked differences of opinion or more animated controversy, than that

of thenatu re of the influences by which these diseases are transmitted from individual to individual. That many epidemics arise from peculiar conditions of the atmosphere, not in the least as yet understood, can hardly be doubted ; and in this case the influence which excites disease simultaneously in many is not dissimilar to that by which contagious diseases are transmitted from individual to individual. Confining ourselves, however, for the moment to this latter mode of transmission, it may be observed that two theories distinctly opposed to each other have long been held on the subject, each of them counting in its advocacy authorities of the very highest character. These may be distinguished as the chemical theory of infection and the germ theory. The chemical theory is founded on a presumed analogy between the propagation of disease in living organisms, and the process of fermentation in certain forms of organic matter without life. This theory assumes a ferment to be an organized substance in a certain state of decay, which possesses the property of exciting the same decay in other organic substances with which it is in contact. Applying this theory to disease, it supposes that infection is communicated by the instrumentality of particles thrown from the person, or from substances proceeding from the person diseased, and borne by the air to other persons in full health, in whom they excite, probably by contact with the membranous linings of the lungs, the same diseased condition which exists in the patient. The opposing theory presumes that the diseased person is suffering from an invasion of his system by microscopic algoid or fungoid vegetative forms having the property of rapid self-multiplication, and that the spores which proceed from these fungi or the cells of the algæ are wafted in like manner by the air from person to person, penetrating the systems of the healthy, and establishing new colonies to generate disease in them.[1]

[1] The germ theory, as it is here stated, and as it is commonly understood, presumes that the minute organisms which cause disease are parasites. Dr. Lionel S. Beale, of London, has put forth a germ theory materially different from this. Holding first that the life of all organisms resides only in that semifluid matter which occupies the interior of living cells, or is seen without an integument in the white globules of the blood, while the cell-walls and the structures built up of them are "formed matter" without life ; and giving the name *Bioplast* to each minute separate mass of this living matter, he shows by the evidence of the microscope, that the bioplasts of the blood multiply by a kind of gemmation, of which the result is to produce other bioplasts resembling the first. In a morbid condition of the blood, however, the process of gemmation is accelerated, and the resulting bioplasts of each generation are more and more minute in size, their numbers becoming incalculably great. These minute bioplasts escaping from the diseased organism, and becoming invested with a protecting coat of "formed matter," may be wafted to great distances and may preserve their vitality for long periods ; so that when, by any chance, they are introduced into the circulation of other organisms, where they find material to be assimilated, they multiply once more in this new habitat with the same abnormal rapidity as before ; and thus engender disease similar to that in which they originated. This theory is developed by Dr. Beale with great ability in his work entitled, *Disease Germs, their Nature and Origin*, published in 1872. According to this theory, disease germs are not parasitical, but "originate in man's organism, and have descended from the normal bioplasm of his body." The theory avoids many of the difficulties which attend the chemical theory on the one hand, and the theory according to which disease is the effect of a parasitic invasion on the other ; but as yet the evidence in its favor cannot be regarded as conclusive.

EVIDENCES FAVORING THE GERM THEORY.

A *primâ facie* evidence, which, so far as it goes, is favorable to the germ theory, is found in the well-known fact that all the forms of cryptogamic vegetation are propagated by spores, which they shed freely abroad in all directions, and that these are borne in infinite numbers through the atmosphere, which they pervade near the surface of the earth in all places. The fact of their universal presence is made manifest by the promptness with which fungoid growths spring up in all circumstances in which the conditions favor their development. Such conditions embrace a congenial temperature, and the presence of some organic substance suitable to serve as a nidus, and furnish for them their proper food. There are peculiar forms of fungus which appear on particular forms of organism and nowhere else. Thus the hoofs of dead horses are overspread, when exposed at a moderate temperature to moisture, with a vigorous growth which is seen in no other situation, and some of the larger plants are infested by their own peculiar fungi.

This constant appearance of minute forms of vegetable life could not take place so invariably in all varying situations were not the spores of the fungi continually present in the air throughout its whole extent. We know that the numbers of these spores which all fungi produce are incalculable. The larger fungi give us evidence of this. The spores of a single puff-ball have been estimated to be more numerous than the entire human population of the globe. It is true that to ordinary observation the presence of foreign matters in the atmosphere is not perceptible, except when such foreign matters take the gross form of clouds of smoke or dust; but particles of smoke or dust, and in general of all inorganic substances, are so heavy that they soon subside; yet when the air is thus left apparently free from all foreign admixture, it is demonstrably full of organic particles so extremely light as not to subside for many hours or even days of perfect rest. The chemist, it is true, is unable to detect them by his tests, delicate as they are; for being organic, and composed in general of but two or three elements — which elements are in great part those of the atmosphere itself — they produce no distinctive reactions under the ordinary processes of analysis. But there is a mode of analysis much more delicate than even that of the chemist. It is that which has been applied incidentally to this question by Professor Tyndall, in his interesting investigation into the chemical effects of light upon vapors. Professor Tyndall discovered that there are many substances of great volatility which, when in the state of vapor, are easily decomposed by light. He found that a perfectly transparent vapor, like steam, when traversed by a luminous beam, is absolutely invisible; while we all know that if we admit a beam of sunlight into a darkened room, through an aperture in the shutter, the path of the beam through the apartment is as distinctly marked as if it were a solid bar. That this visibility of a beam of light in the air is not owing to the power of the aerial particles themselves to reflect light, is demonstrated by him by proofs entirely conclusive. A beam of light from an electric lamp was made in his experi-

ments to pass through a large glass tube closed at both ends by plates of glass cemented on. No light was permitted to escape into the room; and, accordingly, when the tube was exhausted of air altogether, and no light from its interior was reflected to the eye, it was perfectly invisible. But if the air of the room were allowed to reënter it, it immediately became brilliantly luminous, as in the case of a sunbeam admitted through the window shutter. If, however, the air before being admitted into the empty tube had been passed through a red-hot tube of platinum, the tube thus filled remained as completely invisible as when it was a perfect vacuum. This experiment, which is but one of many employed by Professor Tyndall to demonstrate the same proposition, shows not only that the air is full of foreign matters, but that these foreign matters are organic; for, were they not so, they could not be destroyed by fire. He proved also that these particles are so numerous that they cannot be entirely arrested by passing the air through the most energetic chemical reagents, as sulphuric acid, caustic potash, and the like; but that, though these substances arrested a large portion of the organisms, they allowed still not a few to escape. He showed, however, that a filter of rather closely compacted cotton will shut off entirely, or almost entirely, the organic matters which the air contains; and he showed, finally, that absolute rest for a long period of time will cause these particles completely to subside. Thus a large flask which had been standing in the store-room was found to be, as he expressed it, "optically empty;" that is to say, the rays of light passed through it without showing any more trace of their path than if it had been a vacuum. He also experimented to ascertain how long a time would be required to free the air by subsidence of its suspended particles in a space completely closed; and for this purpose he constructed such a closed space, cubical in form and several feet in linear dimensions, glazed so as to permit him to pass through it a beam of light, and to observe the path of the beam. This small apartment was made absolutely air-tight, and left to itself. On each succeeding day the brilliancy of the transmitted beam grew less and less, and at length, at the end of a week, it could no longer be perceived at all. The apartment was optically empty.

These experiments, and others no less interesting, by Professor Tyndall, thus prove in the most conclusive manner, that the ordinary air at the surface of the earth is always completely filled with particles of organic matter. It is not necessary to suppose that all these particles are living germs of vegetable or animal organisms; but when we see how constantly such organisms spring up wherever the conditions favor germination, it is impossible to doubt that a vast many of them have this character; and that these are the source of those growths of minute cryptogams which thus seem to spring up spontaneously. There is no other mode of accounting for such growths, except to suppose that they are actually spontaneous; and accordingly the view has been taken by some physiologists — perhaps I should say many — that the true mode of accounting for the appearance of microscopic forms of life, is to suppose that they originate without organic antecedents, or as these philosophers express it, *de novo.*

THEORIES OF THE ORIGIN OF LIFE.

No question at the present day is more sharply debated than that which relates to the origin of life. There is no subject which has been pursued experimentally with more zeal, more earnest solicitude to reach the truth, or more singularly discordant results than this. The notion of spontaneous generation is not, by any means, of modern origin. It has been entertained by naturalists in every age since the dawn of scientific history. But the earlier naturalists, Aristotle and Lucretius, for instance, conceived that organisms of a high order of complexity, such as insects, or fishes, or reptiles might be directly produced out of the moist earth softened by showers, or out of the slime and mud of rivers; whereas those of our time have long since abandoned any such extravagant notions, and confine themselves to the assertion that life in its spontaneous origin is manifested only under the simplest forms.

The latest example of an hypothesis resembling the ancient is found in the argument presented in a work entitled "Vestiges of Creation," which appeared about thirty years ago, in which the experiments of Mr. Andrew Crosse upon electric currents of low intensity directed for a long time through a solution of inorganic salt, were supposed to have produced an insect of the Acarus family; such an insect having actually made its appearance during the course of the experiment. But this result has long since been recognized to have been merely accidental, and probably owing to the presence of ova of the insect introduced in some unexplained way into the apparatus. The modern advocates of the theory of spontaneous generation hold, however, or at least most of them hold, only to the certainty of the spontaneous appearance of organisms of a very low type, called bacteria, vibriones, and monads, organisms familiar to the microscopist, and which are sure to make their appearance in every putrefying organic infusion.

Less than three centuries ago the belief here spoken of, that living things may originate without eggs, or germs, or living parents from which to proceed, may be said to have been universal in Europe. Of the truth of this belief there was supposed to be visible evidence in the invariable occurrence of maggots in putrefying flesh. Curiously enough, scriptural authority was cited in proof of this view, and the Old Testament story of the bees found by Samson in the carcass of the dead lion, was presumed to confirm it. The doctrine was therefore held as matter of faith, and those who first assailed it were naturally accused of impiety and irreverence. Prominent, and perhaps first among these was Francis Redi, an Italian philosopher, scholar, and poet, born in 1626. He presented a conclusive disproof of the spontaneous generation of maggots in putrefying flesh, by simply inclosing, in open-mouthed jars covered with gauze, pieces of flesh still sound, and leaving them in the sun to putrefy. Putrefaction occurred as before, but no maggots made their appearance. The maggots, nevertheless, did appear on the gauze, and a little observation made their origin manifest. The flies, of which they are the progeny in the larvæ state, being attracted by the odor of the flesh, but unable to reach it, laid their eggs upon

the covering of the jar, and out of these the larvæ were presently developed. Having demonstrated the falsity of the popular belief on this subject in a case so conspicuous, Redi naturally generalized his conclusion, and took the ground that no living thing comes into existence without deriving its life from something previously living. He did not say, as it has been said later, "*Omne vivum ex ovo*," but "*Omne vivum ex vivo.*" He still believed that out of a living plant may arise a living animal, as the insect within the gall of the oak, or the worm within the fruit which presents no external puncture. His doctrine was, therefore, that which Huxley has named *Biogenesis*, in contradistinction to spontaneous generation, called by him *Abiogenesis*, and by Bastian *Archegenesis*. But archegenesis had been put aside only to return again under a new form. Among the earliest revelations of the microscope was the remarkable fact that whenever a dead organic substance is infused in water, myriads of minute creatures presently make their appearance in the infusion, all possessing most extraordinary and many of them very varied powers of reproduction. They multiply by means of *ova*, by means of buds, or gemmation, and by means of self-division, or fissuration. All this was strongly favorable to the doctrine of biogenesis. Where so many means of reproduction existed, every one of them so effectual and sufficient, to provide that the same forms of life should be produced without any organic antecedents, seemed " wasteful and ridiculous excess." This view, however, met here and there with a dissentient. About a century and a quarter ago, John Turberville Needham, an English naturalist, resorted to an experiment which, with various modifications, has been, since, many hundreds and possibly many thousands of times repeated, with the view thoroughly to test the question whether, in its application to infusorial life, the doctrine of biogenesis is universally true. He prepared an infusion, thoroughly boiled it in a flask, corked it tight, sealed the cork with mastic, and covered the whole with hot ashes, designing to destroy by heat any germs which might be in the infusion, in the substance infused, or in the air above the liquid in the flask. After some days or weeks, he found that, notwithstanding all these precautions, living organisms did make their appearance in the flask, precisely such as in freely exposed infusions habitually appeared earlier. This experiment was immediately repeated by Spallanzani, an Italian ecclesiastic and naturalist; but Spallanzani, instead of corking his flask, and cementing his corks, sealed the vessels by fusing the glass, and having thus completely cut off communication with the outward air, kept them at the boiling temperature for three quarters of an hour. No life appeared in the infusions of Spallanzani, and the doctrine of biogenesis was again apparently triumphant.

The question was, however, not yet universally admitted to be settled. Dissentients made themselves heard from time to time, among them Gleichen, Otho Müller, and Treviranus; the latter of whom pointed out the significant fact that, while the species of infusorial animals found in infusions of the same kind were constantly the same, those which appeared in different infusions were not so. Early in the present century the celebrated naturalist, Lamarck, ranged himself on the side of spontaneous generation. Oken

took the same view, and subsequently Bory St. Vincent, J. Müller, Dujardin, Burdach, and Pineau; while on the opposite side appeared, among others, Schwann, Schultze, and Ehrenberg. The experiments of Schultze and Schwann, undertaken for the purpose of testing the accuracy of those of Spallanzani, were remarkable. Subsequently to the date of Spallanzani's experiments, the importance of air, or of oxygen, one of its constituents, to the maintenance of animal life had been discovered, and doubts had arisen whether, in those experiments, the air had not been rendered unfit for the support of life by the operations to which it had been subjected. In repeating the experiments, Schultze admitted to the flasks, after boiling the infusions, only such air as had been passed through concentrated sulphuric acid; and Schwann only such as had been conducted through red-hot tubes. No animalcules made their appearance; and these results, reached as long ago as 1836 and 1837, were regarded by the great body of naturalists as finally settling the question.

RENEWAL OF THE CONTROVERSY.

The controversy, however, after resting for twenty years, was revived and prosecuted with even more animation than before, by Mr. Pouchet, in the first instance, on the side of spontaneous generation, and Mr. Pasteur, on that of biogenesis; but more recently by many naturalists of distinction, among whom may be named Dr. Jeffries Wyman, of our own country, whose experimental researches tend rather to the support of the archegenetic theory, and Professor Huxley, of London, whose opinion, given on a survey of the whole history of the controversy, and expressed before the British Association in 1870, is very decidedly the other way. While the controversy was between Mr. Pasteur and Mr. Pouchet, there can be no doubt that, in the judgment of the world, the former had by far the best of the argument. His experiments, which were substantially repetitions of those of Needham and Spallanzani, but which were variously modified, so as to render his demonstrations, in every possible way, cumulative, seemed to have disposed of the doctrine of spontaneous generation, effectually and forever. In multitudes of instances, infusions hermetically sealed while boiling, remained for indefinite periods of time free from all traces of organic life, while portions of the same infusions exposed side by side with these, but open to the air, were speedily swarming with animalcules. He found that even an unsealed flask, of which the neck had been stopped during the boiling only with a plug of cotton closely pressed together, continued to be equally free from these organisms so long as the stopper remained in its place. This last experiment presented a rather curious resemblance to that of Redi, with his gauze-covered jar; for the cotton forming the plug was found, on a microscopic examination, to contain the germs which its presence had prevented from entering the flask. Mr. Pasteur finally discovered — and this result was long supposed to have furnished an unanswerable reply to all the arguments of the advocates of archegenesis — that flasks containing infusions treated by boiling as before, required neither sealing nor stopping with cotton to prevent invasion of the contained liquids by these low forms

of life; provided that only the necks of such flasks had been originally bent over, so as to direct their mouths downward. This result he had predicted as probable, holding, as he did, that the germs by which such infusions are repeopled when the living embryos they may contain have been destroyed by heat, must necessarily subside into them from the air above.

The experiments of Wyman, Bastian, Cantoni, and others, more recent than those of Pasteur, have led to results singularly, and at present, we must say, unaccountably at variance with his. Professor Wyman found that *bacteria* will make their appearance in infusions which have not only been boiled before being sealed up, but which, after being sealed, have been kept at a boiling heat for many hours. He found, moreover, that these same organisms, after their appearance, perish when exposed to a heat not over 134° Fahrenheit. Bastian, in a very extended series of experiments, has pushed the heat in the tubes containing his infusions as high as 300° Fahrenheit, maintaining this high temperature, in some instances, not less than four hours; and has yet found that living forms do not fail subsequently to appear in them. Such forms appear, also, according to him, in solutions containing nothing of organic origin, whatever, but composed entirely of certain salts of soda and ammonia; and he even affirms that in such solutions he has occasionally seen very remarkable fungi to present themselves with their full fructification, drawings of which he has given in his work, recently published, entitled "The Beginnings of Life."

It seems to me that no one can rise from the perusal of the extraordinary book just mentioned without feeling that, if it does not embrace and contain the conclusion of the whole matter, it is at least for the present unanswerable. It leaves us, nevertheless, still perplexed, perhaps more deeply perplexed than before; for it is impossible to understand how the results reached by so many naturalists, all in the first rank of scientific investigators, all conscientiously laboring to elicit the truth of this great question, should be, after all, so singularly discordant. And another weighty consideration adds to this perplexity. It is the existence of a practical refutation of the conclusions of the class of experimenters to which Dr. Bastian belongs, which is presented under our eyes every day on the grandest scale, in the operations of one of the most important departments of modern industry. I cannot state this consideration better than in the words of Huxley: "There must," remarks this distinguished physiologist, "be some error about these experiments, because they are performed on an enormous scale every day with quite contrary results. Meats, fruits, vegetables, the very materials of the most fermentable and putrescible infusions are preserved, to the extent I suppose I may say, of thousands of tons every year, by a method which is a mere application of Spallanzani's experiment. The matters to be preserved are well boiled in a tin case provided with a small hole, and this hole is soldered up when all the air in the case has been replaced by steam. By this method they may be kept for years without putrefying, fermenting, or getting mouldy." He argues — and the argument has a weight that must be felt — that there is no mode of explaining this universal and invariable result but the exclusion of germs from these cans. And, in

view of the marvelous discrepancy between the results on the small and the grand scale placed side by side, one can hardly repress the suspicion that if there be any such thing as spontaneous generation, it is a thing which occurs only under rare and extraordinary conditions, which conditions Dr. Bastian has unintentionally succeeded in establishing, while as a matter of practical importance or daily interest it is as if it were not.

BEARING OF THE QUESTION ON THE FUTURE OF THE INTELLIGENCE.

There is a view of this question, however, which, though it may seem out of place here, I cannot forbear to mention. To the philosopher, the demonstration of the theory of spontaneous generation, should it ever be demonstrated beyond all possibility of doubt or cavil, cannot but be a matter of the deepest interest. But to the man who finds himself compelled to receive it, this interest, it seems to me, must be no less painful than it is deep. Nor is this the only theory which the investigators of our time are urging upon our attention, of which I feel compelled to make the same remark. There are at least two besides which impress me with a similar feeling, and the three together constitute a group which, though to a certain extent independent of each other, are likely in the end to stand or fall together. These are the doctrine of spontaneous generation, the doctrine of organic evolution, and the doctrine of the correlation of mental and physical forces. If these doctrines are true, the existence of an intelligence separate from organized matter is impossible, and the death of the human body is the death of the human soul. If these doctrines are true, the world becomes an enigma, no less to the theist than it has always been to the atheist.

We are told, indeed, that the acceptance of these views need not shake our faith in the existence of an Almighty Creator. It is beautifully explained to us how they ought to give us more elevated and more worthy conceptions of the modes by which He works His will in the visible creation. We learn that our complex organisms are none the less the work of His hands because they have been evolved by an infinite series of changes from microscopic gemmules, and that these gemmules themselves have taken on their forms under the influence of the physical forces of light and heat and attraction acting on brute mineral matter. Rather it should seem we are a good deal more so. This kind of teaching is heard in our day even from the theologians. Those sentinels on the watch-towers of the faith, whose wont it has been for so many centuries to stand sturdily up in opposition to the science which was not, in any proper sense, at war with them, now, by a sudden and almost miraculous conversion, accept with cheerful countenances, and become in their turn the expounders and champions of the science which is. But while they find the mystery of the original creation thus satisfactorily cleared up in their minds, they seem to have taken very little thought as to what is going to come of the rest of their theology. It is indeed a grand conception which regards the Deity as conducting the work of His creation by means of those all-pervading influences which we call the forces of nature; but it leaves us profoundly at a loss to explain the wisdom or the benevolence which brings every day into life such myriads of sentient and intelligent beings, only that they may perish on the morrow of their birth.

But this is not all. If these doctrines are true, all talk of creation or methods of creation becomes absurdity; for just as certainly as they are true, God himself is impossible. If intelligence presupposes a material organism, of which it is a mode of action, then God must be a material organism, or there is no God. But it is the law of all living organisms that they grow, mature, and perish; and since God cannot perish, he cannot be an organism.

But we are told it is unphilosophical, in the pursuit of truth, to concern ourselves about consequences. We should accept the truth with gladness, whatever it may be, and let consequences take care of themselves. To this canon I am willing to subscribe up to a certain point. But if, in my study of nature, I find the belief forced upon me that my own conscious spirit, as well as my animal life, is but a mere vapor, which appeareth for a little time and then vanisheth away forever, that is a truth which I cannot receive with gladness, and for which I shall never thank the science which has taught it me. Much as I love truth in the abstract, I love my hope of immortality still more; and if the final outcome of all the boasted discoveries of modern science is to disclose to men that they are more evanescent than the shadow of the swallow's wing upon the lake, it seems to me no better than a heartless mockery to talk of the countless treasures which, along with this withering revelation, she has poured out at their feet. No, if this, after all, is the best that science can give me, give me then, I pray, no more science. Let me live on, in my simple ignorance, as my fathers lived before me, and when I shall at length be summoned to my final repose, let me still be able to fold the drapery of my couch about me, and lie down to pleasant, even though they be deceitful dreams.

FACTS AS TO PARASITIC INVASIONS OF LIVING ORGANISMS.

To return from this long digression:—

In order that we may be able to judge of the probability that an infectious disease of which the cause is unknown is a result of the invasion of the blood or the viscera of the patient by a parasitic vegetation, it is important to consider first what has been already ascertained of the effects of such parasitic growths infesting the animal organism. A simple form of fungus, called the *Sarcina ventriculi*, is often found in matters thrown up by persons laboring under disorder of the stomach. It has also been met with in other parts of the body when diseased. But it is likewise found, and not unfrequently, in the stomachs of persons in perfect health; and, as Dr. Carpenter says, it may accumulate there in considerable quantities without causing inconvenience. This parasite, therefore, cannot be regarded as an inciting cause of disease.

The stomachs of many worms and insects are found, moreover, to be frequently infested with fungi, which grow there in great luxuriance. Many of these have been examined and described by Dr. Leidy, of Philadelphia. It does not appear that they occasion inconvenience to the animals within whose bodies they thus establish themselves. On the other hand, some of the dipterous and hymenopterous insects, and some caterpillars, are liable

to invasion by fungoid growths, which speedily spread through their entire bodies and destroy their lives. In the West Indies, according to Dr. Carpenter, it is not at all uncommon to see individuals of a species of *Polistes* (corresponding to our wasp) flying about with plants of their own length projecting from some part of their surface, the germs of which have been introduced through the breathing-pores at their sides. This fungous growth, however, soon kills the insect, and a similar effect follows a similar cause in the case of certain caterpillars in New Zealand, Australia, and China, of which the bodies become so thoroughly interpenetrated and, as it may be said, replaced by the fungoid vegetation, that when dried they have almost the density of wood, so that, in the language of Dr. Carpenter, "these caterpillars come to present the appearance of twigs, with long slender stalks formed by the projections of the fungus itself." Our common house-fly is a not unfrequent victim of a similar parasitic visitation. A fungus called the *Empusa muscæ*, originating from the germination of a single spore brought in contact almost anywhere with the body of the insect, pervades after a time its whole interior, and, while leaving the surface uninjured, emphatically eats out its substance. When the animal's life is nearly exhausted he comes to rest, and fungoid shoots put forth from his body on all sides, clothing him apparently with a kind of fur, consisting of filaments each bearing a fructification of innumerable spores. The harvest of spores becomes very conspicuous when the unfortunate animal makes his last stand upon the window pane, forming a thin film over the glass to a considerable distance around him ; and if by any chance a healthy individual of the same species comes within the limit of this infected area, the disease which has destroyed his fellow will be sure to attack him also. There are some forms of parasitic disease affecting insects which have had consequences of serious importance to certain great industrial interests to which these humble forms of animal life are tributary. A fungus called the *Botrytis bassiana* is the occasion of the disease in silk-worms known by the name of *Muscardine.* The spores of this fungus, entering the breathing pores of the worms, soon germinate, and death is the invariable consequence. It is only, or at least rarely however, the case that the cause of the fatality is manifest until after death has occurred ; but then the fungus shoots forth luxuriantly, especially at the junction of the rings of the body. A still more destructive epidemic among silk-worms is that which has received the name of *Pébrine*, which is caused by the multiplication of a parasitical organism called *Panhistophyton*, fungoid in its nature. This disease is the more difficult to deal with, in that it is transmissible by inheritance, the *Psorospermiæ* entering into the eggs of the diseased worm. It was thoroughly investigated by Mr. Pasteur, who pointed out the means by which it might be extirpated; means which have since been successfully applied. But there are diseases produced by invasions of parasitic fungi in animals of much higher grade than worms or insects. The epidemic among cattle, called in England "the blood," is shown by the researches of Davaine to be occasioned by the presence in the blood of the diseased animals of innumerable living organisms resembling *vibrios.* This disease is communicable to man, producing what is

called "malignant pustule," and this is attended with the development of the same organisms in the pustules thus produced. Professor Lister, an eminent surgeon of Edinburgh, long ago observed that when a chronic abscess is discharged by means of a *canula* and *tröchar*, the subsequent accumulations of fluid are frequently attended with putrefaction, though none had existed before. The putrid mass is also found to be swarming with *vibrios*, though none had been present in the first discharges. No explanation of this singular phenomenon, according to him, can be given, except that the germs of these organisms were introduced in the original operation with the *canula* and *trochar*. Another remarkable fact noticed by Professor Lister seems strongly to corroborate the theory of inflammation and putrefaction above given. A wound in the chest producing effusion of blood in the pleural cavity, is attended with great danger, in consequence of the liability of the extravasated blood to putrefy. Yet when the lung is wounded by a broken rib, without any external opening, the blood, though escaping into the cavity in quantity, undergoes no decomposition and excites in the surgeon no concern, even though air at the same time enters in such volume as to inflate the cellular tissue of the entire body. "These facts," says Professor Lister, "involved to me a complete mystery until I heard of the germ theory of putrefaction, when it at once occurred to me that it was only natural that the air should be filtered of germs by the air passages" of the lungs. Now, what Professor Lister conjectured *a priori*, Professor Tyndall, interested by this remark, subsequently proved experimentally. Through the path of the beam of light made visible by his lantern in the dark room described above, he caused the air from his own lungs to pass, by breathing through a tube. The current at first but slightly affected the brightness of the beam; but as the air from the larger passages passed away, and that from the deeper network of the lungs succeeded, the light progressively faded, and at length gave place to absolute blackness. The experiment fully confirmed the anticipation of Professor Lister, that the air which passed through the lungs would no longer contain the germs of living things, or any other suspended foreign matter. But what an idea does this give us of our liability, through our lungs, to absorb into our systems anything noxious which the air may contain, no matter how minute in quantity, or how finely divided? If the quantity in given volume is minute, it is to be remembered that the volume we inhale in a limited time is enormous, amounting to two or three thousand cubic feet a day; and the accumulation which must result, from even the partial exhaustion of this great mass of its impurities, must become very considerable.

Having spoken now of the cases in which disease, local or general, in animals, is manifestly occasioned by the presence of parasitic vegetation, it is proper to mention, briefly, similar examples in plants. The smut in wheat, the rust in cotton, the *Oidium* in grapes, and the *Botrytis* in potatoes, are examples of fungi, constantly concomitant with disease, and presumably, almost certainly, in the last two instances, its cause. Neither in plants nor animals, however, is it to be supposed that the noxious effects observed are occasioned merely by the presence of these parasites mechanically interfer-

ing with and obstructing the vital functions, or by acting directly as poisons in the ordinary sense: but rather by their own vital activity decomposing the substance of the organisms they infest, and making them their food. The consequences of their extensive prevalence to the material interests of communities and peoples, and to their means of subsistence, have been occasionally of the gravest character. The *Oidium* may be said to have exterminated the vine from the Island of Madeira; the *Panhistophyton* cut down the product of silk in France from 130,000,000 of francs per annum, to 30,000,000; and the *Botrytis* threatened to depopulate Ireland, by destroying the vegetable which constituted, for the common people, the staple article of their food.

THE GERM THEORY AT LEAST PARTIALLY TRUE.

Putting together these, the known facts regarding this subject, before proceeding to more doubtful cases, we may say that the germ theory has an amount of *primâ facie* evidence in its favor which entitles it to careful consideration. In certain instances, and in a certain sense, the evidence is complete that the germ theory is true. But when we come to apply it to infectious diseases in general, we find the analogies which they present with the limited class of examples above enumerated, to be unexpectedly feeble, while the points of dissimilarity are numerous and marked. It is not even enough to discover that in such diseases there are actually present in the blood, or in the tissues, or in the secretions, or in the dejections, of the suffering individuals, living forms of microscopic cryptogams, since the evidence is rarely conclusive either that these minute bodies are injurious to the patient, or that they were present antecedently to the attack. And if, as to the first of these points, the evidence in some cases *is* satisfactory, as to the second it can hardly be pronounced to be so in any.

As to the frequent presence of vegetable organisms in the blood of men or animals suffering under infectious diseases, it is impossible to entertain a doubt. The testimony of all the observers who have occupied themselves with this subject is concurrent to this effect. Coze and Feltz, Klebs, Burdon-Sanderson, Klein, and many others, have found bacteria invariably in the blood of patients suffering under typhoid fever, small-pox, scarlet fever, puerperal fever, pyæmia, and septicæmia. Dr. J. H. Salisbury, of Cleveland, Ohio, affirms, as the result of his own observations, that in healthy as well as in diseased blood there are always present two species of cryptogams, the one algoid and the other fungoid. In the pustules of small-pox Dr. Salisbury has observed a cryptogam described by him as having both a fungoid and an algoid development, and the spores of this he has also found in the blood. In cow-pox, or in the disease produced in the cow by inoculation from a small-pox subject, only the algoid form appears. This the discoverer has named *Ios vacciola*, while the entire plant in its double form he calls *Ios variolosa vacciola*. In typhoid fever the same writer has detected a peculiar algoid vegetation developing itself upon the external surface of the entire body, and upon the mucous membrane of the interior cavities. This he regards as the efficient cause of the disease, and the means by which it is

propagated. Dr. Ernst Hallier, of Jena, who has published largely on this subject, and has made himself prominent as an advocate of the germ theory, has described a large variety of vegetable forms found by him in diseased men and animals, many of which he has subjected to systematic cultivation, in order to study their modes of development. A new and peculiar fungus, found in the rice-water discharges of cholera patients, and within the intestinal canal of such persons, has been cultivated by him with special attention. This plant is described as being as marvelous for the rapidity of its development as for its strange forms of growth, and its terribly fatal destruction of the epithelial tissue of the intestine. It is called by Professors Thomé and Klobe the *cylindrotænium*, but is regarded by Dr. Simon and Dr. Harris as being an exotic member of the family to which belong the *urocystic* and *oidium* blights of cereals and fruits. Among the interesting facts observed in the cultivation, it may be mentioned that the presence of an abundance of nitrogenous matter, and the absence of acids in the fluid or substance employed, were proved to be essential conditions of the propagation and growth. Also, that when the fungus cells, in the course of their development upon a piece of intestinal membrane, reached a certain stage, they rapidly increased, and the epithelium as rapidly wasted away. After reading this, it is rather disappointing to find in the last and recently published edition of Dr. Parkes' "Manual of Practical Hygiene," the following succinct statement: "As regards cholera, the careful observations of Drs. Lewis and Cunningham, in Calcutta, seem to have disproved the possibility of either fungi or bacteria being the *cause* of cholera."

The disease which appeared in 1868 among the beef cattle brought to this city from the West, and which is known as the Texas cattle disease, was investigated at the time by Drs. Harris and Stiles, of the New York Health Department, who found the spores of a peculiar species of fungus both in the blood and in the bile of the diseased animals. Specimens of these cryptogams were sent by these gentlemen to Professor Hallier, by whom they were successfully cultivated, and who succeeded in deriving from them three distinct forms of the fungus. The epizoötic, which attacked all the horses of the country twelve months ago, was also marked by the presence of fungi in the blood and the urine of the animals affected, which were described by Dr. Endemann, and by Dr. Charles Amende, of Hoboken.

These examples will probably be thought sufficiently numerous to justify the generalization that in infectious diseases the presence of microscopic algoid or fungoid cryptogams is a fact of invariable occurrence. What is the significance of this fact? In all these cases, we find that the fluid in which the cryptogams occur is itself diseased. Is not the disease of the blood the very condition that is necessary to the development of the plant? When mould makes its appearance on the surface of paste, is it the presence of the mould which causes the paste to putrefy, or is it the putrefaction of the paste which provides a congenial nidus for the mould?

About forty years ago, the yeast plant was discovered by Cagniard de la Tour, and almost simultaneously by Schwann. Till that discovery, the chemical theory of disease had a strong support in the imagined analogy of

fermentation. To the suggestion, after the discovery, that fermentation is probably a consequence of the rapid growth of the plant, there was at first a very general and natural dissent; but when, in 1843, Helmholtz made a direct experimental test of the question, by placing a fermenting liquid side by side with one of the same kind not fermenting, both being contained in the same vessel but separated by a membrane which permitted the mingling of the liquids, but prevented the passage of the plant, that analogy lost its force, for the fermenting liquid continued to ferment, while the quiescent liquid remained quiescent. The case of fermentation assumed now a significance quite the contrary of that which it had before seemed to possess, and it began to be claimed to be quite as conclusive in favor of the germ theory as it had been before in favor of the chemical. This theory, however, though among its advocates have been, and continue to be, counted many of the most distinguished physicians and physiologists of the past and the present generation, has never met with universal acceptance. Serious difficulties present themselves which it fails to explain, among which are the objections strongly put by Dr. Bastian, that the theory demands a belief in the existence of about twenty different kinds of organisms never known in their mature state, and whose existence is not demonstrated, but simply postulated; and that these germs, if they exist, are not the germs of any known organisms, because such germs have been experimentally shown to be incapable of producing the particular diseases these are assumed to cause. Moreover, feeding on putrid flesh, as is habitual among the Kalmucks, is followed by no injurious consequences, though such flesh swarms with bacteria; and as the author just referred to affirms, the organisms of ordinary putrefactions may be introduced even into the blood of men and animals without producing any of these specific diseases. The same writer asserts that in sheep-pox the blood and the secretions are not infective, though this disease is allied to, and even more virulently contagious, than human small-pox.

DISEASED CONDITIONS THE PABULUM FOR FUNGI.

What accounts shall we give, therefore, of the multiplication of fungi and algæ in diseased blood, if these organisms are not the cause of the disease? Simply, that the diseased condition furnishes to the organisms the pabulum, which is not present in the healthy state. For the cause of the disease we must, on this supposition, look elsewhere, and we shall be compelled, perhaps, to fall back upon the chemical doctrine of sympathetic decomposition. Many causes, in fact, produce profound changes in the blood with which parasites have nothing to do. This is true of the venom of serpents, and of prussic acid, both of which produce fatal effects with singular rapidity. Of "the black death," which raged in the fifteenth century, Bastian quotes Hecker as saying that "many were struck as if by lightning, and died on the spot," and he cites the testimony of Dr. Aitken to the fact that, when the cholera reached Muscat, instances occurred in which only ten minutes elapsed from the first apparent seizure till life was extinct. These are cases for which the germ theory affords no solution.

On the other hand, we have the numerous observations and experiments of Coze and Feltz, of Burdon-Sanderson and Klein, of Klebs, of Davaine, of Zahn and Tiegel, and others, in which rabbits and guinea-pigs were inoculated with bacterious blood drawn from persons laboring under a great variety of infectious diseases, including pyæmia, septicæmia, small-pox, measles, scarlet fever, typhoid fever, etc., observations and experiments which seem to leave little room for doubt that these organisms are, in fact, in these cases, the vehicles of the infection, and the causes of these several diseases. It was observed, for instance, that successive inoculations increase the intensity of the virus, and that along with the increase of toxic power, the number of the organisms in the fluids manifesting it was correspondingly increased. It is true that the diseased fluid is itself necessarily introduced into the animal inoculated, along with the contained bacteria, so as to leave the question still somewhat in doubt to which to ascribe the induced disease. Some light is thrown upon this question by certain experiments of Drs. Zahn and Tiegel, who in cases of septicæmia, filtered the parasites from the liquid ; and having done this, found that the clear liquid caused heavy but transient fever without suppuration, while the same fluid with the parasites produced suppuration extraordinarily wide-spread.

In view of the conflicting character of the evidence surrounding the vexed problem under consideration, the conclusion to which the present speaker has been led, if it may be permitted to one so moderately versed in physiological science to have a conclusion at all, is that neither the germ theory of contagious disease, nor the chemical theory, is exclusively true ; but that each of these morbific influences has a range of action of its own, and that in some cases it is eminently probable that the disease in its inception is attributable to one of these causes, and that is the chemical ; but owes its subsequent virulence mainly to the other, that is, to the presence of rapidly multiplying vegetable organisms. It appears to me that by the proper application of this key we shall be able to solve most of the perplexing anomalies which particular examples have seemed to present, and shall afford a common ground on which the champions of opposing views may meet and harmonize their differences. I make the suggestion with much diffidence, conscious how far I am stepping beyond my own proper province in doing so ; but also on that very account to a certain extent reassured by the consideration that, whatever acceptance it may meet with in this learned body, I have no professional reputation to be prejudiced or advanced in making it.

BEARING OF THE QUESTION UPON PUBLIC HYGIENE.

As to the bearing of this question upon public hygiene, and the principles which should govern sanitary legislation, it is to be observed that, if we accept the chemical theory of contagion as exclusively the true one, we can hardly avoid admitting the possibility that contagious disease may originate in a healthy individual without communication with a person already diseased. The causes, whatever they may be, will be found in surrounding conditions. If I have understood what has been said during the present session of this association, the cholera in the West during the season that is past did not

originate from without. Somewhere conditions must have existed which favored its origination *de novo* in our own country. In this view of the subject, the business of sanitary science is to discover the nature of the deleterious conditions tending to induce disease, and to prevent their occurrence.

If, on the other hand, infectious disease is propagated by living germs alone, what we have to aim at is to devise measures for promptly extirpating those germs the moment the disease appears. But as the necessary measures of precaution or of extirpation will be substantially the same, whatever may be the theoretic views entertained as to the nature and the origin of the evil to be met, our legislation in any case is likely to be practically the same, however in its motive it may be logically different. Pure air, pure water, wholesome food, thorough drainage, rigidly enforced cleanliness, the severe exclusion from towns and cities of industries which contaminate the air with noxious gases or offensive effluvia, especially such as arise from decaying organic matter, the prevention of overcrowding in dwellings, the prompt and complete disinfection of every spot where pestilence may lift its head, and of every article and substance, including the dejecta of the sick, which may serve as a vehicle of disease, and finally, a well-organized sanitary police, and untiring vigilance on the part of its members — these are the objects which the guardians of the public health must labor to secure, to whatever school of ethology they may happen to belong. It is, indeed, a fortunate circumstance, a fact observable in no other department of practical human effort that I happen to remember, that here the champions of conflicting theories, however freely they may splinter lances in the arena of controversy, are always found, in the field of actual warfare and in the face of the common enemy, marching harmoniously side by side.

The study of the laws of hygiene is assuming in our time, in the estimation of the public and of the profession themselves, an importance which places it above even the proper business of the profession, — that of the science of Therapeutics. Drugs, whether remedial or prophylactic, are falling more and more into disrepute; and it is felt that prophylactic action is infinitely better than prophylactic draughts.

Such has been the success of modern measures for closing up all the insidious approaches by which disease has hitherto effected its entrance into the family, the community, or the individual organism, as to encourage a hope, even so seemingly wild and visionary, as that a time is coming in which disease itself shall be utterly extirpated, and men shall begin to live out the days which Heaven intended for them. When that time arrives, if it ever shall, your honorable and learned profession may find, like Othello, its occupation gone; but it will be itself which will have destroyed it, and which will have established, in doing so, a nobler title to the gratitude of mankind than all its untiring labors for the relief of suffering humanity, through centuries of self-sacrificing devotion hitherto, have already won.

HISTORY AND COURSE OF THE EPIZOÖTIC AMONG HORSES UPON THE NORTH AMERICAN CONTINENT IN 1872–73.

By ADONIRAM B. JUDSON, M. D.,
Of New York.

It is probable that Influenza has occasionally appeared as an epizoötic among horses from early times. Passages in the writings of the fourth century are supposed to refer to this disease, and the literature of the thirteenth and seventeenth centuries contains words which indicate the repeated occurrence of this plague. During the eighteenth century, and in the first part of the present century, it made its appearance several times among the horses of Great Britain and the European Continent The descriptions of the latter visitations leave no room for doubt that the disease was the same as that now under consideration.

The ancient accounts of this disease fail entirely to describe its invasive or spreading quality. The more recent accounts give some hint of this interesting feature of the disease. For instance, in 1727, it appeared in England in November and in Ireland in December; in 1750 it did not reach the horses of Ireland till its decline in England, and in 1760 it raged in London and other parts of England in January, February, and March, and seized the horses of Dublin at the end of March. In the present paper it is my purpose to bring into prominence the facts which illustrate the invasive character of this affection, with the hope of throwing light on the method of its progress and thus making a contribution to the study of the laws of epidemics.

Professor Andrew Smith, Surgeon of the Ontario Veterinary College, Toronto, Canada, states [1] that the first cases occurred in the townships of York, Scarborough, and Markham, about fifteen miles north of Toronto, Canada, among the last days of September, 1872. In a letter written by Professor Smith, December 7, 1872, he says: "As far as I can ascertain, the disease originated in this district and generally extended in every direction. It appeared in the neighborhood of Barrie, Collingwood, and Owen Sound . . . . in from eight to fourteen days after the malady broke out here. . . . . In conclusion, I may again state that from recent inquiries, I am convinced the disease first appeared in this neighborhood." Professor Law has studied the meteorological conditions which prevailed at Toronto, and states

[1] *Influenza in Horses*, by James Law, Professor of Veterinary Sciences, Cornell University, Ithaca, N. Y., in the Report of the Commissioner of Agriculture. Washington, D. C., 1872, pp. 206.


Map of the United States
Showing
the course of the Epizootic
among HORSES and MULES in 1872 - 3.
EXPLANATION:
The dates affixed to the Towns and Cities indicate the first appearance of the Disease
This line separates the dates by months
The Railroads are not given east of the Mississippi between parallels 35 and 43 as they are too numerous to show well on this Map.
To accompany a Report presented to
THE AMERICAN PUBLIC HEALTH ASSOCIATION
by
A. B. JUDSON, M.D.
Statute Miles.
JUNE
MAY
APRIL
MARCH
FEBRUARY
JANUARY
DECEMBER
NOVEMBER
OCTOBER
OCT.
Panama, Exempt up to April, 1874
Carthagena, " " May "
Quito, " " June "
Bogota, " " " "
Mazatlan Mex. Middle of March, 1873
Manzanillo . March 19th
Acapulco . 1st. week in April
Minatitlan . Exempt.
Tabasco .
Merida .
Guatemala City. 1st. part of July.
La Union, San Salvador, About Aug. 1.
Nicaragua, Sept. 1873.
Havana, Cuba. Middle of November.
Matanzas . "
Cienfuegos . Latter part of December, 1872
Santiago de Cuba Middle of January, 1873.
San Domingo Exempt.
Hayti "
Jamaica "
BRITISH POSSESSIONS
CANADA
GULF OF MEXICO
ATLANTIC OCEAN
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE

that "there was no extraordinary state, or extreme changes in the weather during the whole month the last days of which witnessed the outbreak." The darkness which surrounds the origin of this epizoötic is impenetrable in the present state of our knowledge of the preservation and revitalization of disease germs.

The following verbatim quotations from newspapers, and from the correspondence with which I have been favored, truthfully and graphically describe the salient features of this epizoötic. The following extracts show that all, or nearly all, horses and mules were affected: —

"There are not fifty horses in the city free from the disease." — *Ottawa, Canada.*

"We had very few horses unaffected." — *Montreal.*

"At least seven eighths of the entire number of animals in this city were suffering from the disease." — *Boston, Mass.*

"More than three fourths of all the horses in the city are affected." — *Providence, R. I.*

"The horses not affected by it are the exceptions." — *New Bedford, Mass.*

"There is scarcely a horse left that is not affected." — *Newport, R. I.*

"The actual number of horses affected is only equaled by the number in the city." — *Wilmington, Del.*

"The disease has reached nearly every horse in the city." — *Corry, Penn.*

"The malady is absolutely universal among our equines." — *Pittsburg, Penn.*

"Scarcely a horse in the city is free from it." — *Bloomington, Ill.*

"Three fourths of the horses in the city are stricken with the disease." — *Knoxville, Tenn.*

"The epizoötic has attacked nearly every horse in this city." — *St. Joseph, Mo.*

"Few horses in this city are exempt from it." — *Lake City, Fla.*

"Nearly every horse in the city is more or less affected by it." — *Camden, Ark.*

"The great majority of the horses are more or less affected." — *Selma, Ala.*

"Nearly every horse or mule is more or less affected." — *Natchez, Miss.*

"Almost every horse in our city has it." — *Dallas, Oregon.*

"Nearly all the horses in the town have it." — *Walla Walla, Wash. Terr.*

"A great number of horses and mules were attacked." — *British Columbia.*

"The disease was very general, very few horses, mules, or asses, escaped it." — *Manzanillo, Mexico.*

"They all had it." — *Acapulco, Mexico.*

"Probably very few horses or mules entirely escaped." — *Corinto, Nicaragua.*

"In every stable where there are horses and mules together, both are affected alike." — *Norfolk, Va.*

"A majority of the work horses and mules of the city are more or less affected." — *Charleston, S. C.*

"Many horses and mules have died from the effects of the epizoötic." *Marianna, Fla.*

"About twenty deaths were reported last night among the mules in the Louisville (Ky.) City Railway Stables."

"It attacked horses, mules, and jacks." — *Mazatlan*, *Mex.*

The presence of the epizoötic in a city produced a great change in the appearance of the business thoroughfares, as is shown by the following extracts: —

"The streets yesterday were almost deserted by teams of every description." — *Bangor*, *Me.*

"There has been a marked absence of horses from the streets to-day." — *Nashua*, *N. H.*

"The streets are almost deserted." — *Washington*, *D. C.*

"A Sunday quiet prevails upon the streets." — *Springfield*, *O.*

"The epizoötic made Market Street more quiet than it usually is on Sunday." — *Chattanooga*, *Tenn.*

"The withdrawal of horses from the streets is almost universal. — *Denver*, *Colorado.*

"The streets of this city presented a most deserted appearance yesterday, so far as teams and vehicles were concerned." — *Virginia City*, *Nevada.*

"The streets yesterday looked deserted." — *San Francisco*, *Cal.*

"The city passenger cars will partially cease running for a few days." — *Montreal*, *Canada.*

"The street cars have stopped." — *Erie*, *Penn.*

"The cars of the West Ward Passenger Company were taken off last evening." — *Easton*, *Penn.*

"The absence of cars from the streets was the subject of general comment." — *Norfolk*, *Va.*

"Yesterday at noon the street cars on the main line were withdrawn." — *Wheeling*, *West Va.*

"The cars of the Adams Street railway stopped running this morning." — *Toledo*, *O.*

"The running of the cars on the High Street railroad was entirely suspended yesterday." — *Columbus*, *O.*

"Our street railroad was compelled to suspend operations yesterday." — *Evansville*, *Ind.*

"On account of the epizoötic the street cars will cease running regularly until further notice." — *Salt Lake City*, *Utah Terr.*

"On every line a number of cars have been drawn off." — *San Francisco*, *Cal.*

"Ox-teams are being used wherever they can be obtained." — *Fall River*, *Mass.*

"Very few horses are to be seen, oxen supply their places." — *Parkersburg*, *West Va.*

"Oxen are now employed by several of our merchants in draying." — *Columbus*, *Ga.*

"The horse has almost entirely disappeared from the street, the ox becoming more and more the chief reliance for transportation." — *Cincinnati*, *O.*

"Many of our merchants have resorted to ox-teams." — *Milwaukee, Wis.*

"The stage has come in for the last two or three days drawn by oxen." — *Vermillion, Dak. Terr.*

"An extra number of ox-teams were brought into service yesterday by butchers and teamsters." — *San Francisco, Cal.*

The damaging effects of the epizoötic on business interests are set forth in the following extracts : —

"Expressmen are unable to fill their orders, and the warehouses were yesterday filled with goods awaiting shipment." — *Boston, Mass.*

"At the various railroad depots and piers freight is rapidly accumulating." — *Philadelphia, Penn.*

"Our grocery men, provision dealers, etc., are delivering their goods by means of hand-carts, wheelbarrows, and wagons drawn by man-power." — *Pottsville, Penn.*

"On the wharves scarcely a horse is to be seen, and business has consequently received a sudden and severe check." — *Wilmington N. C.*

"Impossible to get transportation for the ordinary wants of trade." — *Baltimore, Md.*

"Many of the farmers are greatly retarded in bringing their fall crops into the market on account of the malady." — *Jacksonville, Fla.*

"There is complete stagnation of freight for lack of drayage." — *Houston, Tex.*

"What shall we do without mails ? is the question asked on every hand. All the coaches have been withdrawn." — *San Antonio, Texas.*

"Yesterday business began to feel its effects. Drayage which usually costs two dollars and a half, doubled its price." — *Cairo, Ill.*

"It is difficult to procure carriages, or even a hearse for a funeral." — *St. Louis, Mo.*

"From that day to this (one week) not a single letter has left for the East, or arrived at our town from thence." — *Cimarron, New Mex.*

"Vegetable, milk, bread, and ice teams fail to make regular calls on their customers, and many are entirely neglected. There has been considerable inconvenience the past few days, and a great deal of freight in consequence still remains in the business houses. The illness of nearly 3,000 horses has caused between 5,000 and 10,000 men to be idle." — *San Francisco, Cal.*

"Great inconvenience is suffered on account of the epizoötic, which has dismounted the cavalry." — *The Lava Beds, seat of the Modoc Indian War.*

"It prevailed to such an extent as to seriously interfere with all business." — *Havana, Cuba.*

The following extracts present the popular view of the symptoms and nature of the disease : —

"There was scarcely a horse to be seen on the streets that did not show signs of the distemper by coughing and a discharge from the nostrils." — *St. John, N. B.*

"Every one of the sixty horses in the barn was affected, and such a coughing, wheezing, and blowing of noses no horseman ever heard before." — *Springfield, Mass.*

"The lungs were found in a high state of congestion, and the throat and all the respiratory organs much diseased." — *Lynchburg, Va.*

"The horses are seized with coughing, followed by a running at the nose and chilliness." — *Charlotte, N. C.*

"The symptoms were the oft-described ones of wheezing, sneezing, and running at the nose." — *Mobile, Ala.*

All the animals attacked have a cough, sore throat and fever, with generally a running at the nose." — *Kansas City, Mo.*

"The horses seem to be suffering from a severe cold, with running at the nostrils." — *Elizabeth City, New Mexico.*

"At and near Fort Whipple all the animals are coughing, sneezing, and pining away." — *Prescott, Arizona.*

"A drooping languor seemed to pervade the entire stable. Their eyes were more or less dim, and the heavy cough could be heard in all directions." — *San Francisco, Cal.*

"The horses affected manifest the usual symptoms of a cough, and profuse mucous discharge from the nose." — *Marysville, Cal.*

"They are all attacked in the usual manner, slight shivering at first, then running at the nose." — *Oakland, Cal.*

Horses were seized with hard, dry cough, sneezing, glanders, followed by extreme exhaustion." — *Cienfuegos, Cuba.*

"The animal has no appetite, and a continual coughing follows." — *Guatemala City.*

"Symptoms, loss of appetite, fever in about ten days, continued from three to sixteen days, followed by cough; some had a discharge of yellow mucus from the nose, others not; duration variable from two to eight weeks; great loss of flesh." — *La Union, San Salvador.*

The symptoms and complications are described by Professor Liautard, of the New York College of Veterinary Surgeons, in the following words:[1] —

"The symptoms presented by the cases of simple influenza in the city of New York, have been, with few exceptional cases, rigors, febrile action, impaired appetite, sneezing, cough, nasal discharge, accelerated respiration, weak and compressible pulse, dry fæces. The attack was very sudden; the animal would be apparently well in the evening, and sick the next morning. The chills were generally followed by profuse perspiration. There was repeated sneezing. The cough was hard, difficult, dry, and spasmodic, even to such an extent as to threaten suffocation. In the majority of cases there was an abundant discharge from one or both nostrils, — first mucous, afterward muco-purulent in character. This flow was rendered more profuse by an excessive flexion of the head. Sometimes this discharge appeared entirely purulent, and was often expelled after a paroxysm of coughing and sneezing, in large cheesy masses. In these cases the frontal and maxillary sinuses were principally affected. These symptoms were usually attended with more or less febrile action, though in some cases this was absent.

[1] *Report on the Epizoötic as it appeared in New York*, by A. F. Liautard, M. D., V. S., Consulting Veterinary Surgeon to the Board of Health, in the Appendix to the Annual Report of the Board of Health, New York, for 1872. New York, 1873, pp. 276.

The larynx and intermaxillary organs were painful, and pressure upon them was followed by a spell of painful coughing. Respiration was more or less accelerated and difficult, depending in the first stage of the disease on the diseased condition of the anterior air-passages. The pulse was peculiar, sometimes 40 to 50 per minute, seldom more than 70. In all cases it was very weak and compressible. The temperature of the rectum varied from 101° to 105° Fahr. In exceptional cases it was as high as 106° or 107.° Thermometric observations indicated that the temperature varied very much in the different stages of the disease. From 101° it would increase in a few hours to 104° or 105°, and then decrease to 103°, these oscillations being noticed as long as the disease lasted. In some cases the temperature remained above 100° for some time after the animal had recovered. Loss of appetite was often the first symptom, and loss or impairment of the appetite occurred in every case, with very few exceptions. In many cases where dry food was refused, the appetite could be excited by providing fresh carrots, turnips, apples, or potatoes, raw or boiled. The ocular mucous membranes varied in appearance, in some cases being normal, in others slightly congested, and in many cases showing a well-marked yellowish hue. The mouth was sometimes very warm and dry, but in many cases it was quite normal, with the exception of an abundant flow of thick saliva. The submaxillary lymphatic glands were slightly enlarged and painful; but I saw only one case in which these glands suppurated. The thyroid bodies were more or less enlarged. The fæces were usually hard, dry, and passed with difficulty; ocasionally they were soft. The urine was sometimes voided in great quantity, and toward the end of the disease it was often slightly bloody, thick, and turbid. The movements of the animal were feeble and staggering (the *titubante* walk of the French). The skin was dry, and the hairs dull and staring.

The duration of the mild catarrhal form is from two to three weeks, after which the animal can resume his work. In a few cases the symptoms disappeared altogether in eight or ten days, while in others more than a month elapsed before the nasal discharge had entirely ceased.

The most common complications were thoracic. Pleurisy and pneumonia destroyed a large number of animals. A few cases of tympanitis and of colic, from impacted food, or from indigestion, were also observed, but none proved fatal. The nervous system was affected in a few cases in the form of cerebral or spinal meningitis. In these the result proved quite satisfactory. Many of the hard-worked animals were attacked with purpura hæmorrhagica (the *mal de tête de contagion*, or *anasarque*, of the French), and a large number of these cases terminated fatally. In these cases the dropsy was general and excessive. The mucous membrane of the nasal passages and of the eyes was marked with petechiæ. The nasal discharge became bloody. As the œdema of the extremities increased, the skin cracked and permitted the blood to ooze through it. Locomotion became difficult and mastication impossible. The temperature was high, and the pulse weak, compressible, small, and soft, numbering from fifty to seventy-five per minute. The respiration was accelerated and short, and an offen-

sive odor was exhaled from the nostrils. Many animals were destroyed, under the impression that they were affected with glanders or farcy. This complication usually terminated in death after a period varying from a few hours to four or five days. Hæmaturia often existed, either as a primary symptom or as a complication, but never assumed a serious nature. Severe attacks of laminitis of two or four extremities were often seen. Another complication, of frequent occurrence, not serious in character, and confined to horses reduced by hard work, poor food, and bad stabling, was œdema of the extremities, extending from the knee or hock down to the hoof. This œdema, which was often mistaken for the dropsical swelling of purpura hæmorrhagica, disappeared with a little exercise, and reappeared as soon as the animal was returned to the stable. This complication permanently disappeared as soon as the animal regained his appetite and strength."

Professor Liautard's views concerning the treatment are contained in the following words:[1] —

"The treatment of influenza must be in accordance with the symptoms. During the simple catarrhal form of the disease the diet should consist of dry or boiled oats, mashes, oat, rye, or corn-meal gruels, roots, and fruits. These articles should be varied and given in small quantities. The temperature should be regulated by blanketing, bandaging of the extremities, and general or local friction. Good ventilation should be secured, and disinfectants used in moderation. In the majority of cases the hygienic measures above mentioned, together with rest, will prove entirely sufficient to effect a cure. Rest is of the utmost importance. Without it the animal will scarcely escape some of the sequelæ of the disease. Experience has taught me that rest is of paramount importance, for all those animals whose labors were suspended as soon as they were taken sick, escaped complications, and resumed work in a few days. On the other hand, a large mortality occurred among railroad and stage horses. Many of these animals, being kept constantly at work, were attacked by serious complications, purpura hæmorrhagica being the most frequent, and perhaps the most fatal. If the throat is swollen and painful, stimulating liniments, mustard applications, or blisters, must be used. Steaming with boiling water and with decoctions of poppy-heads or marsh-mallow leaves, with the administration of electuaries of belladonna, renders the cough less painful, and if mixed with some preparation of antimony, such as kermes mineral, facilitates expectoration. A tendency to constipation may require injections containing soap or sulphate of soda.

Bleeding, sedatives, purgatives, and setons, must be entirely laid aside, or, when resorted to, it should be with great discretion. The practitioner should ever bear in mind that this affection is essentially of an asthenic character. As there is debility almost at the very outset, the disease requires not antiphlogistic measures, but supporting treatment almost from the beginning. This is especially the case if the appetite is impaired, the pulse weak and small, and the walk staggering. Under these conditions, diffusible stimulants, such as preparations of ammonia, or camphor, com-

[1] Op. cit., p. 278.

bined with vegetable tonics, such as gentian or cinchona, are indicated. Drenches of ale or of brandy have been successfully administered, but they must be used with care on account of the laryngitis which sometimes exists.

The complications must be met with such treatment as each case may require. The treatment adopted by me in purpura hæmorrhagica included stimulating frictions to the swellings, fomentations of decoctions of aromatic plants, drenches of bitter and aromatic tonics, such as chamomile or elder-flower tea, and scarifications when necessary. Peruvian bark or gentian was used in combination with mineral tonics, especially the sulphate, phosphate, or iodide of iron, or in some cases with the bisulphite of soda, or a few drops of carbolic acid. These combinations were given in powders or pills, or in drenches, according to the appetite and the facility of deglutition. The hypodermic injection of quinine and citrate of iron has been successfully employed. Diuretics may also be administered. Of these, oleum terebinthinæ, in ounce doses, is perhaps the best. In larger doses it is liable to give rise to abdominal troubles. If diuretics are used, the urinary secretion is to be carefully watched, so as to avoid hæmaturia, which very often appears. Where the purulent collection in the sinuses is very abundant and the frontal bone displaced by the pressure of the pus, and where respiration is thus impeded, I would recommend trephining, a simple operation affording immediate relief, not attended with danger, and leaving no disfigurement after cicatrization."

The mortality caused by the epizoötic was estimated for the city of New York by the following method: During the six weeks following the appearance of the disease in New York, there were, according to police returns from the rendering dock, 1,946 deaths among horses, a weekly average of 324. As the normal weekly average was 89, it follows that 235 (324 — 89) represents the weekly mortality caused by the epizoötic, and that 1,412 (235×6) represents the mortality caused by the epizoötic during the six weeks in which it affected the rate of mortality. As all, or very nearly all, the horses were affected, it may be said that the epizoötic was the first cause of death in 1,410 cases, and the second cause in 536 (1,946 — 1,410) cases. A census taken by the Health Department in 1870 makes the number of horses 38,272. A calculation based on these figures shows that 3.7 per cent. of the horses in New York were destroyed by the epizoötic.

The following is an abstract of the results of post-mortem examinations made by officers of the Board of Health of New York: —

Case I. October 31, 1872. Bay horse. Sick about ten days with cough, loss of appetite and weakness. Pulse 74, respiration 30, temperature 102°; muco-purulent nasal discharge, extremities œdematous, staggering gait, eye dull. Killed by a blow on the head. Mucous membrane of maxillary sinuses and nasal passages inflamed and covered with semi-fluid, muco-purulent matter. Pharynx, larynx, and trachea, normal; both lungs moderately congested. Other viscera normal.

Case II. November 2, 1872. Black horse, pulse 108, respiration 28,

temperature 102°. No œdema; dark-brown fluid discharged from nostrils. Nasal passages congested, especially the covering of the turbinated bones; larynx and anterior portion of trachea normal; posterior portion of trachea and bronchi and bronchial tubes congested; superior portion of lungs actively congested; inferior portion in advanced stage of pneumonia. Respiratory passages and bronchial tubes contained dark-brown matter similar in color to the pneumonic lung tissue. Other viscera normal.

Case III. November 4, 1872. Similar to Case II.

Case IV. November 5, 1872. Sorrel horse. No œdema; actions quick and intelligent; a copious white frothy discharge from the nostrils was scattered about by the forcible expirations of the animal; pulse 60, temperature 100¼°. The lining membrane of the nasal passages, trachea, and bronchial tubes, as far as they could be distinguished, healthy. The air-passages contained several ounces of a milky fluid. Section of the inferior portion of the lungs showed a dark-red congested condition, section of the anterior portion was at first normal, but almost instantly changed to a vivid scarlet. Pressure on the latter sections forced from the finer tubes a frothy milk-white liquid resembling that found in the trachea and discharged from the nose. Liver congested. Other viscera normal.

Case V. November 7, 1872. Section of œdematous parts was of a very dark-red color.

Case VI. showed a remarkable contrast between the normal condition of the pharynx and base of the tongue, and the intense congestion of the superior surface of the soft palate and the lining membrane of the larynx.

Cases VII. and VIII., November 16 and 27, 1872, were well-marked cases of purpura hæmorrhagica, and strikingly illustrated the dyspnœa and extravasation into the muscular tissues.

The accompanying maps have been prepared to show the rate of progress made, and the direction taken by the epizoötic from its starting point until all the horses within reach had been affected, when it ceased to act, apparently for the want of susceptible animals on which to exert its power. The facts on which these maps are based have been taken from the letters of correspondents, who have most kindly placed the results of their observation at my disposal, and from the newspapers. Early in the progress of the epizoötic it was seen that the journalists were actively interested in recording the remarkable features of this visitation. The extracts already given show how widely this interest was felt. As the disease passed from city to city, its progress was anxiously watched and recorded. The local reporters in those places which were yet free from the disease were on the alert to detect and publish the occurrence of the first cases. It repeatedly happened that the epizoötic was announced in certain cities before it had actually appeared, and the mistake was duly corrected in subsequent issues of the newspapers making the mistake. But when a city was really attacked, the local papers at once began to publish column after column concerning the epizoötic. Their daily and weekly readers were supplied with descriptions of symptoms and advice in regard to prevention and treatment, with ac-

counts of its disastrous effects on business and items of news concerning its appearance, progress, and decline in other places. It thus happened that the popular demand for information on this subject produced, in the newspapers, a current and accurate history of the progress of the disease. Access to this history was obtained through the kindness of Mr. George P. Rowell, of the Advertising Agency, at No. 41 Park Row, New York, where the successive numbers of all the daily and weekly papers printed in the United States are systematically filed and preserved for six months after their issue.

The result of a careful review of the newspapers and of the correspondence above mentioned has been the following table of dates. In many cases the dates are fixed with exactness by the statements of those who were anxiously expecting the appearance of the disease; in other cases they have been determined approximatively, in the absence of the definite statements of observers. In all cases, however, there is good reason to believe that the date of the serious manifestations of the disease is fixed within a week or two weeks of the actual time of their occurrence. In certain cases, as will be seen, it has been deemed important to indicate briefly the authority on which the dates have been determined.

TABLE OF DATES OF THE APPEARANCE OF THE EPIZOÖTIC OF 1872–3.

CANADA.

Toronto: Letter from Andrew Smith, Surgeon of the Ontario Veterinary College, Toronto, November 20, 1872: "The disease first appeared in this district in an epizoötic form about the end of September, although possibly a few isolated cases may have existed a short time previous. On Monday, the 30th of September, I found fourteen horses affected in one stable." Barrie, Collingwood, and Owen Sound: second week in October. See Andrew Smith's letter of December 7, 1872 (p. 88). Peterborough, Port Hope, Bobcaygeon, Belleville, and Ottawa: second week in October. Kingston, "The Daily News," October 18, 1872: "As yet we have not heard of its visitation to Kingston." October 19: "The contagion has at length reached Kingston." Goderich: third week in October. Montreal: October 8th. Letter from D. McEachran, M. R. C. V. S.: "Referring to my case book, I find the record of the first case under date October 8." Quebec: October. St. John N. B.: second week in October. Halifax, Nova Scotia: November. Prince Edward Island: exempt. Letter from David Laird, editor of "The Patriot," Charlottetown, P. E. I.: "It did not reach Prince Edward Island. At the time the disease was raging in the other provinces, the navigation was closed, and our island entirely cut off, in the way of export or import, from the main land, which fact must have been the reason it did not cross to our shores."

NEW YORK.

Niagara Falls: October 10. Buffalo: October 13. Letter from William Somerville to a Buffalo newspaper of October 15, 1872: "On Friday last (October 11) I was called by telegraph to the Falls to see several sick horses. . . . And now the disease has got among our horses in Buffalo."

Rochester: third week in October. Syracuse, "Daily Journal," October 22, 1872: "On Saturday of last week (October 19) the disease made its appearance in this city." Utica, Oswego, Watertown, Schenectady, Saratoga Springs, Elmira, Jamestown, and Poughkeepsie: fourth week in October. Ogdensburg, Letter from M. E. Thomas, V. S.: "The epidemic of influenza first made its appearance here . . . . on Monday, October 21." Albany, "Evening Journal": "The first case was reported on Wednesday" (October 23). New York City: October 20. Report of Professor Liautard:[1] "On the evening of October 21st, only a few animals were affected, but on the morning of the 22d I doubt if there was a single animal of the equine species which was not attacked. Horses, mules, and even a zebra belonging to a menagerie, were affected almost simultaneously." Kingston, November 1; Nyack, October 30; and Ithaca, October 31. Report of Professor Law:[2] "On October 30 it was reported for the first time in Peekskill and Nyack, N. Y. On the 31st it appeared . . . . in Ithaca, N. Y., having existed since the 25th in Trumansburgh, ten miles to the northwest of the place last named, and slowly reached Varna, three miles to the east of Ithaca, on November 6."

CONNECTICUT.

Waterbury, "Daily American": "It first appeared . . . . Sunday morning, October 27." Norwich, "Daily Advertiser": "The first case was discovered . . . . Wednesday morning" (October 23). Hartford and New Haven: fourth week in October.

RHODE ISLAND.

Providence: October 23. Newport: fourth week in October.

MASSACHUSETTS.

Boston, "Daily Advertiser": "The first case reported was . . . . on Sunday afternoon" (October 20). Springfield, "Daily Republican": "It broke out . . . . Tuesday afternoon (October 22). Worcester: October 27. Fall River and New Bedford: fourth week in October.

VERMONT.

Burlington, "Free Press and Times": "The epizoötic made its first appearance in this city on Saturday" (October 26). Rutland, "Daily Herald": "Sunday morning (November 3) suddenly, without any premonitory symptoms, the disease broke out." St. Albans: fourth week in October.

NEW HAMPSHIRE.

Concord: last week in October. Nashua: fourth week in October. Portsmouth: October 23.

MAINE.

Bangor: third week in October. Bath: October 28. Portland: fourth week in October.

PENNSYLVANIA.

Philadelphia, "Press": "The Canadian horse disease reached Philadelphia on Saturday morning" (October 26). Harrisburg, Lancaster, York,

[1] Op. cit., p. 276.

[2] Op. cit., p. 210.

Erie, and Corry : fourth week in October. Pittsburg, "Commercial" : "The disease first appeared on Tuesday evening" (October 29). Meadville, "Evening Republican" : "The first evidence of the disease in this city was noticed . . . . Saturday" (November 2). Titusville : October 28. Bethlehem, Easton, Reading, Williamsport, and Pottsville : first week in November. Scranton, Professor Law : "November 13 reached Scranton."

NEW JERSEY.

Trenton, "Daily State Gazette," October 29, 1872 : "There is no case in the city." November 4 : "Yesterday the disease spread with great rapidity ; some seventy-five animals having taken the disease since Saturday" (November 2).

DELAWARE.

Wilmington, "Daily Commercial," November 6 : "It has been a matter of much comment that Wilmington has so long escaped. . . . . Thirteen cases are reported."

MARYLAND.

Baltimore, "American" : "Only made its appearance on Friday or Saturday" (October 25 or 26). Washington, D. C. : October 28.

VIRGINIA.

Norfolk and Richmond : last week in October. Lynchburg : second week in November.

WEST VIRGINIA.

Wheeling, "Intelligencer" : "Yesterday (November 13) some twelve or fifteen horses showed symptoms of it in the first stage." Parkersburg : second week in November.

OHIO.

Steubenville, "Daily Herald" : "The disease made its appearance in this city on Friday evening" (November 15). Cincinnati, "Commercial" : "The first appearance was . . . . on Friday night" (November 8). Columbus, "State Journal" : "The first symptoms were observed on Saturday morning" (November 16). Zanesville, "Daily Courier" : "The first cases of the disease . . . . were developed . . . . on Saturday last" (November 16). Dayton, Sandusky, and Toledo : second week in November. Springfield : third week in November. Cleveland : fourth week in November.

INDIANA.

Indianapolis, "Journal" : "The first authentic case was attacked Sunday night" (November 17). Evansville : November 21. Fort Wayne and Lafayette : third week in November. Terre Haute and Madison, fourth week in November.

MICHIGAN.

Detroit : About October 16. Port Huron : third week in October. East Saginaw, "Daily Courier" : "Attention was first drawn to the horses first seized on the morning of Thursday" (October 24). Jackson, "Daily Patriot" : "The first symptoms appeared on Thursday" (November 7).

Grand Haven, "Daily Herald": "This unaccountable disease broke out in Grand Haven this morning" (November 8). Kalamazoo, "Daily Telegraph": "Last Saturday afternoon (November 9) the first case occurred here." Adrian: second week in November.

ILLINOIS.

Chicago, October 29, "Daily Tribune": "On the 20th instant there were brought to this city from Canada ten horses. The animals were stabled at No. 612 West Jackson Street. Four or five days after their arrival eight of them were taken sick; to save the other two, they were removed to No. 609 West Madison Street. At the time of their transfer these two horses were perfectly well to all appearances; but on Saturday or Sunday last (October 26 and 27), they showed symptoms of the 'Canada disease,' and with them twenty other horses." The disease proved to be the epizoötic. Cairo: first week in December. Quincy, "Daily Herald": "It arrived Sunday" (December 8). Peoria, "Daily Transcript": "It seems to have made its appearance no longer ago than last Wednesday" (November 27). Bloomington: third week in November. Galesburg: fourth week in November. Galena, "Evening Gazette": "Yesterday morning there was not a case of the new horse disease in Galena; last evening (November 20), a few cases came to light."

IOWA.

Davenport: November 14. Keokuk, "Daily Constitution": "Yesterday (November 25) this disease made its appearance." Dubuque and Iowa City: third week in November. Muscatine and Des Moines: fourth week in November. Burlington: last week in November.

NEBRASKA.

Omaha: December 1. Lincoln and Nebraska City: first week in December.

WISCONSIN.

Milwaukee: first week in November. Janesville and Green Bay: second week in November. Madison and Fond du Lac: third week in November. La Crosse: fourth week in November.

MINNESOTA.

St. Paul: third week in November.

DAKOTA TERRITORY.

Yankton, "Press": "The disease first made its appearance here last Thursday" (December 5). Vermilion: first part of December.

KENTUCKY.

Louisville, "Courier-Journal": "On Saturday night (November 9) a number of horses . . . . were observed to be ailing." Paducah: fourth week in November.

TENNESSEE.

Memphis, Nashville, and Chattanooga: third week in November.

NORTH CAROLINA.

Raleigh: first week in November. Charlotte and Newbern: fourth week in November. Wilmington, "Journal": "It first made its appearance here on Tuesday" (November 12).

SOUTH CAROLINA.

Charleston, first week, and Columbia, second week in November.

GEORGIA.

Savannah: second week in November. Augusta and Atlanta: third week in November. Macon, Rome, and Columbus: fourth week in November.

FLORIDA.

Jacksonville and Lake City: fourth week in November. Marianna and Tallahassee: first week in December. Middle Florida: winter of 1872-3. Key West, exempt. "Weekly Dispatch," May 24, 1873: "Key West has been singularly exempt from this disease."

ALABAMA.

Mobile, Montgomery, and Selma: fourth week in November.

MISSISSIPPI.

Natchez and Vicksburg: fourth week in November.

LOUISIANA.

New Orleans, Report of S. S. Herrick, M. D., Sanitary Inspector, in Annual Report of Board of Health for 1872: "The earliest access of the distemper learned was November 21; but of this there may be some doubt, as no other cases occurred until the 25th." Shreveport: second week in December.

TEXAS.

Galveston: fourth week in November. Houston, "Daily Telegraph": "Yesterday (November 29) there were thirteen cases of a serious disease among the horses of this city." San Antonio: January 3, 1873. Brownsville: third week in February.

ARKANSAS.

Helena: third week, and Little Rock, last week in November. Camden, "Weekly Journal": "Several horses on Saturday and Sunday last (December 7 and 8) developed unmistakable symptoms." Fort Smith: third week in December.

MISSOURI.

St. Louis, "Missouri Democrat": "Saturday there was not a single case in St. Louis; but by Monday (December 2), over twenty were reported." Kansas City, first week, and Hannibal, second week in December. St. Joseph, "Daily Gazette": "On Saturday last (December 14) the first symptoms were discovered."

KANSAS.

Fort Scott, Lawrence, Leavenworth, and Topeka: second week in December.

COLORADO TERRITORY.

Denver and Central City: fourth week in December. Pueblo: first week in January, 1873.

WYOMING TERRITORY.

Cheyenne: second week in January, 1873.

NEW MEXICO.

Cimarron, first week, Elizabeth City, second week, and Albuquerque, fourth week in January, 1873.

ARIZONA TERRITORY.

Prescott: first week in March, 1873. Tucson: second week in March. "Weekly Citizen," March 15, 1873: "The stage animals westward are attacked. Eastward all seems right again." Yuma: fourth week in March.

UTAH TERRITORY.

Salt Lake City, second week, and Corinne, third week in January, 1873.

IDAHO TERRITORY.

Boise City: third week in March. "Tri-weekly Statesman": "The epizootic has reached this place through the overland stage company's horses from the East."

MONTANA TERTITORY.

Helena: fourth week in March.

NEVADA.

Winnemucca: middle of February. Gold Hill and Virginia City: first week in March.

CALIFORNIA.

Inyo, "Southern Californian," March 13, 1873: "The epizoötic has broken out in Inyo with great fury. . . . Inyo caught it from Carson City." Bakersfield: third week in March. Santa Barbara: fourth week in March. Visalia: third week in March. San Diego: first week in April. Oakland: April 10. Mariposa, Stockton, San José, Sacramento, Marysville, and Shasta: second week in April. San Francisco, "Bulletin," April 15, 1873: "The horses here have not yet been affected." "Alta California," April 19: "The epizoötic has reached our city." Vallejo, Nevada City, Weaverville, Yreka: third week in April. Lava Beds, seat of Modoc Indian War: fourth week in April.

OREGON.

Jacksonville: fourth week in April. Baker City, "Democrat": "It made its first appearance . . . . in this city yesterday morning (April 8). Eugene City: third week in May. Portland and Dallas: fourth week in May.

WASHINGTON TERRITORY.

Walla Walla: last week in April. Olympia: May. Steilacoom: first week in June. Seattle: third week in June.

BRITISH COLUMBIA.

Letter from David Eckstein, Esq., U. S. Consul at Victoria, B. C.: "On the main-land the disease broke out, I believe, in July. . . . . Victoria City, and in fact all of Vancouver's Island, remained unscathed by what is known as the epizoötic. Not a single case is known to have occurred here up to the present (November 15, 1873). For several months no horses or mules were allowed to be landed at the ports of Victoria, Burrard Inlet, or Nanaimo."

CUBA.

Havana, letter from Henry C. Hall, Esq., Vice-consul-general: "The disease did not become epidemic here until about the 20th of November." "Horses from the United States and Canada were imported into this island during the month of September, 1872." Letter from A. T. A. Torbert, Esq., Consul-general: "The disease was said to have been introduced by a span of American horses imported for the governor." Cienfuegos, letter from John Sullivan, M. D.: "In Cienfuegos, about the end of December, a few isolated cases appeared." Santiago de Cuba, letter from A. N. Young, Esq., U. S. Consul: "The disease first made its appearance about the 15th of January (1873), was at its height during February, and disappeared early in April. . . . . There were about one hundred deaths among horses in the city. . . . . I witnessed the advent of the disease in Cincinnati in the early part of November last (1872), and also here during the above mentioned period. I do not think the horses suffered as much here during the attack as in Cincinnati, probably on account of the milder temperature here."

HAYTI.

Letter from Ebenezer Bassett, Esq., Port au Prince, July 8, 1873: "The epizoötic has never yet made its appearance in this republic." Louis Sanne, Esq., Acting U. S. Consul, Aux Cayes, June 26, 1873: "The disease in question has not appeared yet here." Stanislaus Goutier, Esq., U. S. Consul, Cape Haytien, June 26, 1873: "This disease has never made its appearance in Hayti."

SAN DOMINGO.

Letter from J. Ginebre, Esq., Puerto Plata, July 21, 1873: "The epizoötic has hitherto not appeared among the horses or mules of this island." Fisher W. Ames, Esq., Santo Domingo City, June 13, 1873: "I have not seen a single case of any disease that even simulates it."

JAMAICA.

Thomas H. Pearne, Esq., U. S. Consul, Kingston, July 15, 1873: "The disease has not to my knowledge ever appeared here."

MEXICO.

Monterey, letter from J. Ulrich, Esq., U. S. Consul: "The epizoötic made its appearance here between the 1st and 10th of February last (1873). . . . . At Saltillo, seventy miles west of Monterey, the disease prevailed

also in a mild form. Saltillo has an altitude of over 5,000 feet above sea-level." Guaymas: A. Willard, Esq., U. S. Consul: "The epizoötic appeared at this place last March (1873), its entrance to our place being distinctly marked in its march from Arizona." Mazatlan, Isaac Sisson, Esq., U. S. Consul: "The epizoötic made its appearance in this city and neighboring towns in March last (1873), say about the middle." Manzanillo, A. Morrill, Esq., U. S. Consul: "The first case of the real disease appeared on the 19th of March (1873)." Acapulco, John A. Sutter, Esq., U. S. Consul: "The epizoötic made its appearance in the vicinity of the port of Acapulco during the first week of April" (1873). La Paz, David Turner, Esq., U. S. Consul, June 20, 1873: "No signs of the epizoötic have been noticed in this territory." Minatitlan, John A. Wolf, Esq., U. S. Consul, July 2, 1872: "The epizoötic has really not appeared here." Tabasco, Aug. J. Cassard, Esq., U. S. Consul, July 5, 1873: "In this consular district that epidemic has never arrived, and is totally unknown." Merida, Marlin F. Hatch, Esq., U. S. Consul, October 16, 1873: "The epizoötic has not appeared in the state of Yucatan."

GUATEMALA.

Guatemala City, Henry Houben, Esq., U. S. Consul, July 15, 1873: "The aforesaid disease made its appearance in this city a few days ago."

SAN SALVADOR.

La Union, J. F. Flint, Esq., U. S. Consul: "An epidemic disease commenced amongst the horses and mules in this department about the 1st of August" (1873).

NICARAGUA.

Corinto, Rufus Mead, Esq., late U. S. Consul: "It made its appearance in this State sometime in September (1873). . . . . The symptoms were as you describe them, and in some cases there was swelling under the belly."

UNITED STATES OF COLUMBIA.

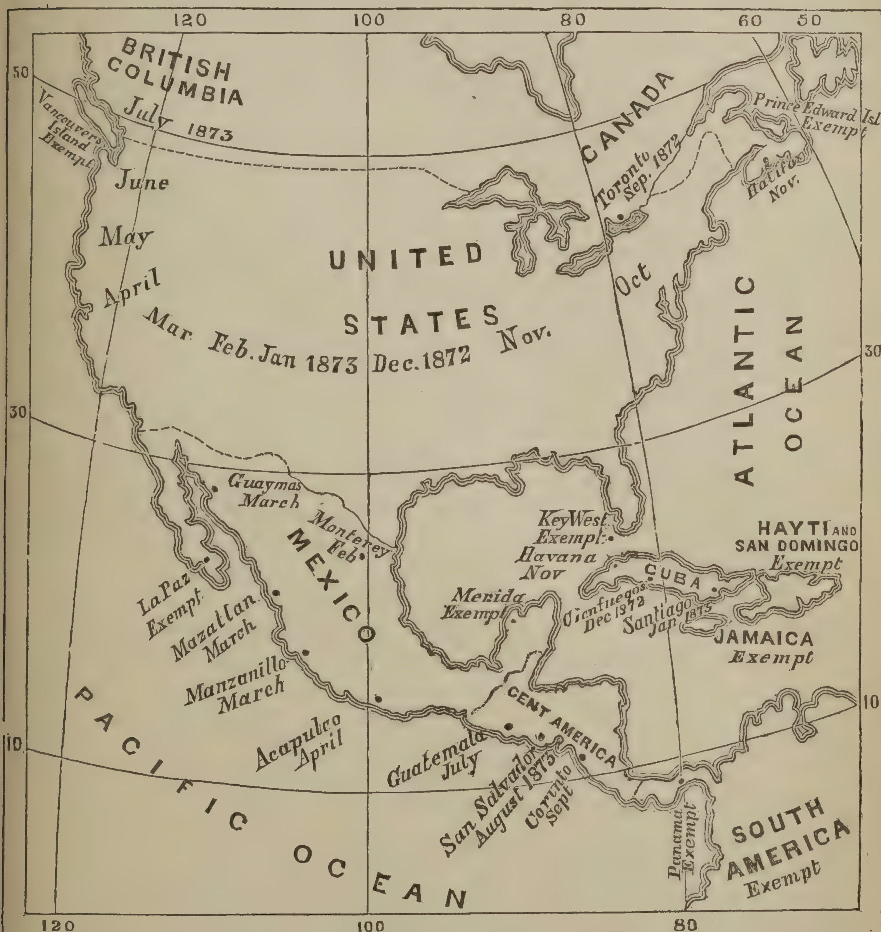
Panama, Owen M. Long, M. D., U. S. Consul, April 23, 1874: "Up to this present writing I have not heard of a single case of epizoötic. I hardly think it will ever reach this part of the world, as we have but few horses and not a great many mules . . . . There is very little travel in this country in consequence of the entire absence of good roads. We can drive out of Panama in a carriage only about a mile and a half." Carthagena, Augustus S. Hanabergh, Esq., U. S. Consul, May 23, 1874: "There has been no distemper of any kind among the horses of this place for several years past, neither have I heard of the existence of any disease among those animals in any part of this country, with such symptoms as you describe." Bogota, William L. Scruggs, Esq., U. S. Minister Resident, June 5, 1874: "I am somewhat familiar with the disease, having had considerable experience with it among my own horses, and those of my neighbors and friends, in Georgia, before leaving for my post of duty in Columbia; and I am safe in saying that none of the symptoms have, up to this time, appeared among the horses here, or in the immediate vicinity. Indeed, I am not aware that

the epizoötic, or anything like, has made its appearance in any part of Columbia."

ECUADOR.

Quito, Rumsey Wing, Esq., U. S. Minister Resident, June 1, 1874: "Up to this date there has been no appearance of the epizoötic in this city, and so far as I am aware, in this country."

Up to this date (Oct. 3, 1874), there has been no mention of the recent appearance of this epizoötic among the horses of Europe, in the Veterinary Journals of London, Paris, or Brussels.



MAP OF NORTH AMERICA, SHOWING THE COURSE OF THE EPIZOÖTIC OF 1872–73.

The propositions and conclusions derived from the preceding facts are presented below in words taken from my report on this subject, prepared

by the direction of the Sanitary Committee of the Health Department of New York City, and printed in the Appendix to the Annual Report of the Board of Health of New York City for 1872.

Proposition No. 1. — Epizoötic influenza does not spread by virtue of any of the recognized atmospheric conditions of cold, heat, humidity, season, climate, or altitude.

The proof of this proposition amounts to a demonstration, as will be seen by a reference to the maps. The disease prevailed and was propagated in the cold of a northern winter, and in the summer heat of Central America; in the dry air of Minnesota, and in the moist air of the sea-board; at an altitude of 5,000 feet above the sea, at Saltillo, Mexico, and on the low levels of New Orleans, La. (ten feet above sea-level), and Galveston, Texas (five feet above sea-level).

Proposition No. 2. — Epizoötic influenza does not spread solely by virtue of unrecognized atmospheric conditions.

During the prevalence of the disease, the opinion was expressed, by many thoughtful observers, that it was spreading through the air, or by virtue of some unknown atmospheric condition. In no other way did it seem possible to explain the sudden prostration of all, or nearly all, of the horses in a city or limited district. Subsequent investigation has not proved that the disease is *not* communicable through the air at short distances, and over limited areas. They have proved, however, that the spread of the disease over the country is not solely, or chiefly, by virtue of unrecognized atmospheric conditions.

The irregularities in time and place, in the appearance of this disease, are so numerous and surprising that they cannot be classified or brought into harmony with any system of laws that bears any resemblance to the laws which govern the phenomena of any of the recognized atmospheric conditions. Some of the irregularities may be appreciated by examining the larger of the accompanying maps with the assistance of the arcs and radii that have been drawn from Toronto, where the disease first appeared, as a centre. It will be seen that the disease appeared at places equally remote from its starting point, at widely different dates; for instance, at Montreal, Canada, Oct. 8; Burlington, Vt., Oct. 26; Rutland, Vt., Nov. 3; New York, Oct. 21; Trenton, N. J., Nov. 2; Columbus, O., Nov. 16; and Grand Haven, Mich., Nov. 8. It will also be seen that the disease appeared simultaneously at St. Louis, Mo., and Galveston, Tex., the latter place being twice as far, in the same direction, from Toronto as the former, These are but instances taken from a countless number of similar facts to be found all over the map.

By these considerations proposition number two is logically proved, unless we are willing to believe in the existence of an unrecognized atmospheric condition whose phenomena are governed by laws which bear no relation of resemblance or analogy to the laws which govern the phenomena of the recognized atmospheric condition.

Proposition No. 3. — Epizoötic influenza spreads by virtue of its communicability.

Experiments for the *demonstration* of this proposition have been wanting. The incidents attending the appearance of the disease at Chicago, Ill., as recorded on page 100, approach closely to a satisfactory demonstration. If the statements in regard to the appearance of the disease at Chicago had been the result of scientific observation, they would have demonstrated our proposition.

Admitting the present impossibility of demonstration, we have abundant and convincing *logical proof*, as follows : —

1. It is logical proof that epizoötic influenza spreads by virtue of its communicability, that no place was exempt from the disease which was known to have been in communication, by means of horses or mules, with places in which the disease existed.

On the main-land of this continent every place which is known to have had communication, by means of horses or mules, with places where the disease existed, suffered from the disease. In regard to the West India Islands, we have letters from two correspondents (p. 103), which mention the importation of American horses into Havana, and Cuba was overrun by the disease.

2. It is logical proof that epizoötic influenza spreads by virtue of its communicability, that the places that were exempt from the disease were so situated that the importation of horses or mules was in some of them impossible, and in others of them improbable. The following places were exempt : Prince Edward Island, Vancouver's Island, Key West, the Islands of Hayti and San Domingo, the Island of Jamaica, La Paz, and that portion of Mexico containing Minititlan, Tabasco, and Merida.

Prince Edward Island and Vancouver's Island were sequestered, the former by the severity of a Canadian winter, and the latter by a quarantine against horses and mules. The Islands of Key West, Hayti and San Domingo, and Jamaica, have limited commercial intercourse with the ports of this country or with Cuba, and the importation of horses or mules is probably a very rare occurrence. La Paz, near the extremity of the peninsula of lower California, is so situated that, in all probability, there is no unbroken communication by horses and mules with those portions of Mexico in which the disease prevailed. The same statement can be made concerning Minititlan, Tabasco, and Merida, as the region in which they are situated is separated from the states of Vera Cruz and Mexico, in which the disease prevailed, by difficult and thinly settled lowlands.

[It is further logical proof, recently come to hand, that epizoötic influenza spreads by virtue of its communicability, that the disease ceased to spread only when it had affected all the susceptible animals within reach. The last point at which its presence is reported is Corinto, Nicaragua, where it appeared in September, 1873, just a year after it took up its line of march from Toronto, Canada. The question whether it would pass into South America was answered in the negative by the letters already quoted from Panama, Carthagena, and Bogota. I am informed by Lieutenant-commander G. C. Schulze, U. S. Navy, a veteran explorer of the Isthmus, that overland communication, by means of horses or mules, between North and

South America is an impossibility. From Panama to the Atrato river, a distance of two hundred and fifty miles, the country is an almost impassable swamp intersected by rough and difficult mountain ranges. The only inhabitants are a small number of half-civilized negroes and savage Indians.]

3. It is logical proof of this proposition that the disease passed rapidly over those regions in which the towns and cities are numerous and in frequent communication with each other, and with comparative slowness over those regions in which the towns are less numerous and in less frequent communication with each other.

An examination of the maps will show that the disease spread rapidly over the States east of the Mississippi and Missouri rivers, where cities and towns are numerous, and where communication is rapid and easy; and that the rate of its progress was greatly reduced as it passed over the thinly settled States and Territories of the western half of the country where communication is slow and difficult.

There are many minor points which illustrate the fact that the rate of progress made by the disease depended on the amount and facility of commercial intercourse. Some of these points are, in brief, as follows: The early appearance of the disease at New York, Philadelphia, Baltimore, and Washington, places situated on a crowded line of travel, and its late appearance in a large region lying between these cities and the starting point of the disease, as well as in certain important cities and towns lying near, but not on this great line of travel; the rapid progress of the disease along the line of the Pacific Railway; the arrest of the disease by the Sierra Nevada mountains, impassable by horses and mules at the season of the approach of the disease, and its invasion of California after flanking the mountains by way of the succession of mining districts between Carson City, Nevada, and Inyo, California; and the division of the current of the disease by the Sierra Nevada mountains and the unoccupied territory in Northern California and Oregon, one division moving more rapidly than the other by reason of passing over a more thickly settled region. The early appearance of the disease at New Orleans, La., and Galveston, Tex., has caused the surmise that infected horses were landed at those ports by some of the numerous coasting steamers from New York and Philadelphia.

Conclusions. — One of the results of the investigations detailed in the preceding pages is the confirmation of the opinion commonly held by medical authorities, that epizoötic influenza is the counterpart of epidemic influenza. They are both specific febrile diseases, in which the specific poison produces disordered function of the chief nervous centres, and acts on the mucous membrane of the eyes, of the nose, and of the bronchi.

The definition of influenza given in Aitken's "Practice of Medicine," applies with exactness to epizoötic influenza, if a few unessential words are omitted. Leaving out the subjective symptoms, and substituting *epizoötic* for *epidemic*, this definition reads as follows: "A specific febrile disease, invariable in its essential characteristics, frequently prevailing as an epizoötic, attended with lassitude and prostration to an extreme degree; chills, the eyes injected and tending to fill with tears, the nostrils discharging an

acrid fluid; cough prevails, with yellow expectoration. Fever attends the disorder, sometimes slight and sometimes severe, and of a type varying in different epizoötics and localities."

Epizoötic influenza is the counterpart of epidemic influenza, not only in its pathology and definition, but also in certain other important features which are common to both diseases, among which are the following: 1. It has at intervals overrun portions of the globe from early times; 2. It attacks all, or nearly all, individuals; 3. The rate of mortality is low, the prognosis depending on the condition in which the disease finds its victim, and on his ability to secure rest and supporting treatment, rather than on the intensity of the specific poison.

As the effects of the prevalence of epizoötic influenza on commerce, and on the general welfare of the community, are extremely injurious, inquiries in regard to its method of propagation, and in regard to practicable measures of prevention, are very important, the more so as the facts obtained will probably apply to its counterpart, — epidemic influenza. The result of the preceding inquiries into the methods of propagation of epizoötic influenza is the presentation of abundant and convincing proof that it spreads from city to city, and from country to country, by virtue of its communicability, and regardless of atmospheric conditions. This proposition should be qualified by the statement that the apparently sudden seizure of all the horses in a city, or limited neighborhood, renders it possible that within narrow limits it infects through the atmosphere.

From the views of this subject presented above, it is evident that the introduction of epizoötic influenza can be prevented by arresting communication through horses and mules, with those localities in which the disease prevails. Its importation by sea can be prevented by quarantine regulations. Its transportation overland can be prevented by the establishment of a *cordon sanitaire;* but this means would, from the nature of the case, be successful only under exceptionally favorable circumstances.

In regard to epidemic influenza, the same rules probably hold good; but their application is impracticable. The arrest of intercourse between two adjacent countries or sections, or the enforcement of quarantine regulations with the necessary stringency, would probably be considered more disastrous than an epidemic of influenza.

II.

REPORTS UPON EDUCATIONAL, SOCIAL, AND VARIOUS PHYSICAL CONDITIONS RELATING TO HYGIENE.

REMARKS UPON ONE OF THE FIRST PRINCIPLES OF HOSPITAL HYGIENE.

By Hon. JAMES W. BEEKMAN, of New York.

It is beginning to be recognized that hospitals should be destroyed and renewed every ten years. The walls become saturated with poisonous matter emanating from the bodies of the sick, and no fumigation or disinfectants have proved efficacious. After a few years the safety of patients requires freshly-built wards, — and these wards must contain but few beds, and be situated in detached and temporary buildings.

The new pavilions or wings lately built, adjoining the Hotel Dieu, in Paris, have been abandoned while yet unfinished, because French surgeons and physicians began to see that the conditions of cure were wanting in the old hospital, and that to reproduce these old types of hospital building would be merely to continue a treatment which had been found by very long trial to be baleful to the inmates. So they now propose pavilion cottages, far out of the denser parts of the great city, and managed in the *style of* the American Ambulance, which by fresh air and avoidance of crowding, saved so many lives of the wounded during the seige of Paris.

Doctor Mundy, of Vienna, has constructed in the Park of St. Cloud, under the old trees there, a row of wooden hospitals, in which the results of treatment were found satisfactory, although the windows were on one side of the building only, and dampness from the ground was not properly guarded against. Doctor Mundy, who has large experience in military hospitals, considers shade-trees important as purifyers of the air, and desires cottages for the sick to be placed under or near groves of trees. In America, Doctor Benjamin Rush, during the war of 1812, caused the patients from one of the military hospitals, who were suffering from bad ventilation, to be carried every morning into a neighboring orchard where the men passed the day under the apple trees, and recovered wonderfully. In Edinburgh, there is a new Infirmary constructed in the old way, with large, three-storied stone buildings standing in a row about thirty feet apart, and not yet complete, against which Sir James Y. Simpson used to protest— but in vain. That noble and learned physician, who first proved the virtue of anæsthetics in allaying pain, by himself inhaling chloroform, and boldly essaying the unknown results of its benumbing power, among his other

priceless benefactions to humanity, taught the true doctrine of hospitalism. By the answers to an extended series of circular letters of inquiry, he established the fact that out of 2,089 cases of amputations performed in great hospitals in cities, 855 died; while in country practice, out of 2,098 similar operations, only 226 died. Hence, the number that die after amputations in hospital practice, when compared with rural practice, is nearly *four times* greater.

It seems probable that the chances of recovery from fever or from the results of a surgical operation, are, on the whole, greater in a squalid home in any large city even, than in the largest and best-appointed hospital in London or Paris, so dangerous is the concentration of many sick to each individual patient. An influence capable of causing disease emanating from one or from a few invalids, is usually so dissolved and diluted as to be harmless. From a large ward, however, exhalations perceptible to the smell are generated, which saturate the very walls and poison successive series of inmates; while, as we have seen from Sir James Y. Simpson's demonstration, *four times* as many of the original admissions die as might be saved under proper conditions. The European hospitals are, in many respects, inferior to some of our own. Too often the surgeon's aim seems to be to discover and classify the malady, rather than to cure. Diagnosis thrusts aside therapeutics.

Quarantines appear so vexatious and yet so useless, that one of the most valuable objects of research in sanitary matters lies in that direction. In Egypt, last winter, a rigid quarantine was established against cholera, just above Luxor, on the Nile, at Silsilis. Yet the people of Assouan, the infected village, came and went by land, being only debarred by the *cordon sanitaire* from their accustomed river travel by boat. No cholera was conveyed by these people, and when the coffle of Abyssinian slaves at Assouan, which was said to be dying of cholera, had run away or died, the quarantine was removed, and no harm ensued. Cleanliness, and prompt attention to the drinking-water of an infected locality, ashore or afloat, seem the surest quarantine. In former days the plague continued in London in spite of quarantined rags, while the same rags from the Levant were freely imported into cleanly Holland without harm. As soon as better sanitary measures were taken to keep up a clean and healthy order of things in England, the plague was heard of no more. But perhaps the most important, because the most comprehensive of the topics likely to come before this Association, is the cause of disease—how sickness spreads, how the morbific influence may be weakened and (by whatever name called, whether contagious or infectious) why, in nurse's phrase, certain diseases are *catching*—these are queries worthy of the most careful study. By the collection of many facts, by the comparison of many opinions, and by the conference of many experts, such knowledge can only be attained. And should your deliberation result in shortening the number of days passed in the sick-bed, or in increasing the percentage of cures in surgery, or best of all, in showing how to stamp out epidemics and pestilential diseases, or to materially weaken their power, your labors will receive lasting honor.

NOTE. In the study of Hospital Hygiene during the last few years, the remarkable fact has been disclosed again and again that the great hospital is as liable to destroy life as to save it, unless unusual intelligence and watchfulness pervade the sanitary administration of its affairs.

Hon. James W. Beekman has for many years been one of the most enlightened and fearless advocates of the dominion and paramount claims of Hygiene in our public hospitals, and the utterance which he has briefly given in this place is in full accordance with principles and practice upon which he and the masters of medical and surgical knowledge assert the necessity for great reforms in public hospitals. To such plain sense and boldness as Mr. Beekman's and Miss Nightingale's, in stating reasons and giving methods for reforming the common hospital system, in structure and management, the public will give heed.

Even in a recent attempt to defend the administration of certain great hospitals, in which the death-rate, as shown by Dr. William Farr, of the Registrar-general's office, has even been nearly twice as great as in the same classes of patients in the cottages and tenements of the poor and middle classes of the population, Dr. J. Matthews Duncan, F. R. S. E., remarks: "I dare say a hospital could be so constructed and managed as to kill all the inmates." This fact, that by means of faulty construction and mismanagement a hospital may destroy the lives of its inmates, led Miss Nightingale "to enunciate as the very first requirement in a hospital, that it should do the sick no harm." That gifted woman proceeds further to say: "It is quite necessary to lay down such a principle, because the actual mortality in hospitals, especially in those of large, crowded cities, is very much higher than any calculation founded on the mortality of the same class of diseases among patients treated out of the hospital would lead us to expect.[1]

In breaking away from bad examples and long cherished plans of hospital construction, such reasons as these which have been stated by Hon. Mr. Beekman will need to be deeply impressed upon the minds of the directors and physicians who are directly concerned in the construction and service of hospitals. Though it may be easier to tear down than to build, and less difficult to criticise than to execute faultless work, the advocates of hospital improvement have studiously deliberated upon each problem of reform, and prepared themselves to show what are the best methods of structure and management of hospitals, before advising the substitution of the new for the old plans. The Secretary of the Public Health Association takes this occasion, while thus collecting a few points in evidence to corroborate the propositions laid down by Hon. Mr. Beekman, to adduce some of his own testimony previously given for the purpose of presenting in contrast various important facts relating to the new and the old, the reformed and the unreformed methods. These passages are quoted from his centennial address before the Society of the New York Hospital. He commends to us his opinions when he says, "To do good, to do the best for the sick poor, ought to be our ambition." To illustrate and enforce the correct principles of hospital construction, he has presented the following quotations of evidence from

[1] *Notes on Hospitals*, 3d edition, page 3.

great masters in sanitary and medical knowledge, whose words are here given as jewels in his own careful setting. Describing the first pavilion hospital in New York, namely, the one constructed after the plan furnished by Dr. John Jones, he states that the wards were twenty-four feet wide, by eighteen feet high, all well ventilated, not only from the opposite disposition of the windows, but proper openings in the side walls, and the doors open into a passage or gallery thoroughly ventilated from north to south.

Mr. Beekman presents the following from the address of Captain Douglas Galton, of the Royal Engineers of the British Army, as delivered in 1869: "A simple, inexpensive hut, for a few beds, capable of perfect ventilation, and admitting of being occasionally pulled down and rebuilt with fresh materials, at no great expense, would, in all probability, afford more recoveries from fevers and wounds than the most costly special hospital wards." Again, Mr. Beekman reverts to the most concrete expression of sound principles, and says, "The architectural necessities are light, air, speedy removal of refuse, and great facility of cleansing. Architectural display in a hospital is a crime."

"Buildings used for the reception of the sick become permeated with organic impurities. . . . . Evidence came that our buildings were no longer fit to do proper service. In cleansing one ward, out of five masons who were removing the plaster, three died of fever in a few days." . . . . Continuing this statement, and turning it in the direction of clinical instruction, he remarks: "Is not that the best school which exhibits to its students not merely the diseases they are to be taught how to recognize, but the treatment also under which the mortality is least, and the days of sickness, in each recovery, are shortened to the smallest possible number? In cases of wounds or surgical ailments, are not the best clinical lectures to be found at those bedsides where the skill of the surgeon is rewarded by prompt recovery of the largest number of his patients?" [1]

In a most valuable chapter upon *improved hospital plans*, Miss Nightingale remarks: "It is practicable, no doubt, to ventilate more or less effectually a complicated building, but practically it will never be done. Whenever the form of hospital construction requires much thought to be applied to its ventilation and other sanitary arrangements, it may be considered quite certain that the hospital is not a safe one for the sick. Practically, it is impossible to escape from this, viz., that safe hospital construction must, at whatever (apparent) cost, contain a maximum of facility, and minimum of difficulty for keeping every part of the building healthy."

The British Government Commission for improving the sanitary condition of barracks and hospitals, declare in their report that, "It should never be forgotten that the object sought in the construction of a hospital is the recovery of the largest number of sick men to health in the shortest possible time, and that to this end everything else is only subsidiary." To the accomplishment of this sacred purpose of a hospital, the medical and the secular officers of each institution need to concentrate all their efforts.

[1] See *Centenary Address before the Society of the New York Hospital*, by James W. Beekman, pages 13 to 25.

They declare that each human life which is consigned to hospital care is to be saved if possible, and with the least harm or delay within hospital wards; and to this end must they demand that sanitary engineers and the architect shall contribute, no less than the medical officers, by all the resources at their command. There should be no failure to provide for each patient that enters a hospital ward, every facility to help to the most speedy and complete cure may be afforded. Says Dr. Stephen Smith: "It is not only by delaying the recovery of the sick that hospitals fail to answer their humane purposes; they may, by their unhealthiness, expose their inmates to new and fatal diseases. It is not an unfrequent occurrence that patients enter general hospitals with simple and curable diseases, but contract other maladies, of a more fatal character, of which they die."[1]

In an admirable report upon Hospitals and Hospital Health, by Doctors Bristowe and Holmes, in the Sixth Privy Council Medical Report, those masterly observers recite the catalogue of "hospital diseases originating in hospitals," among which are pyæmia and diffuse inflammation, and they also enumerate the diseases which, originating outside, yet spread and destroy in hospitals. In their analysis of three hundred and forty-four consecutive cases of amputation in the London hospitals, they show that forty-two died from direct, or what seemed to be inevitable effects of the wounds and operations, and that sixty-one other deaths occurred from various causes, of which no less than thirty-seven died of so-called hospital diseases.[2]

The soundness and vital importance of the statements made by Hon. Mr. Beekman are sustained upon every hand. Perfect and perpetual purity of the atmosphere surrounding every bed and filling every ward is his humane demand as a hospital governor. At his side stand the masters in hygiene and surgery, and in the words of John Simon, all unite in the statement that "so thoroughly does a hospital depend for its usefulness on the capacity of its wards for the *most exquisitely perfect ventilation*, that in all plans of hospital construction this is the one cardinal virtue to be insisted on. The ventilation must be such as shall leave no corner unsearched by its currents." The simplicity of structure, the skillful completeness of ventilation from floor to ceiling and ridge, from side to side and end to end of every ward, and the reasonably wholesome and humane separation or grouping of patients, are realized and fully illustrated in pavilion and tent hospitals only. E. H.

[1] *Principles of Hospital Construction*, by Stephen Smith, M. D., p. 4.
[2] *Sixth Report of Medical Officers of the Privy Council*, p. 561.

ON THE RELATIVE INFLUENCE OF CITY AND COUNTRY LIFE, ON MORALITY, HEALTH, FECUNDITY, LONGEVITY, AND MORTALITY.

By JOHN STOCKTON-HOUGH, M. D.,
Of Philadelphia.

"Pericula mille sævæ urbis."

Social systems spring from the convenience, indolence, sympathy, sociability, and the rivalrous vanity of human nature. Sociability owes its origin to civilization, and civilization is formed and fostered in cities. Indeed, civilizing is only citizenizing or conforming to, and adopting the manners, habits, and peculiar life in cities.

"Aristotle was wiser when he fixed upon sociability as an ultimate quality of human nature, instead of making it, as Rousseau and so many others have done, the conclusion of an unimpeachable train of syllogistic reasoning." Morelly, the contemporary of Rousseau, says that man, "though composed of intelligent parts, generally operates independently of his reason; his deliberations are forestalled, and only leave it to look on while sentiment does the work."

The great ultimate aim of human nature is sociability. Every man looks forward to a time when he will have more leisure to give to his friends, to enjoy with them interchange of thought and hospitality. As man emerges more and more from a savage or semi-barbarous state (state of nature), he first acquires property, place, ease; then cordiality, hospitality, and sociability; and to facilitate all these, he must needs congregate with his fellows; hence arise towns and cities.

In our present theme we have to do with the ill effects on health, mortality, and longevity, arising from prolonged or continuous life in cities. And these effects can best be shown and appreciated by comparison with the much more favorable results of life in the country.

On these several conditions hang the fates of principalities and powers Well and truly has the Roman poet said, "*Pericula mille sævæ urbis*" — a thousand perils beset the great city, — and these words have as much weight and meaning to-day as they had centuries ago.

On the other hand, the unsparing praises of life in the country, with its attendant happiness, healthfulness, and purity, found in the poems of Virgil,

Horace,[1] and Cowper,[2] are not less worthy of our careful consideration and thoughtful reflection.

The writer in the course of his statistical researches has so frequently observed the ill effects of city life, that he was led to inquire whether the noticeable decline in health, fecundity, and longevity of the human race, and of the American people in particular, were not due to the too great crowding into cities; and he finds from an investigation of the subject that he is warranted in his belief.

That there is a well marked and fully appreciated decline in the health, fecundity, and longevity of the people of the United States, we have only to refer to the investigations of those of our fraternity who have given the subject much thoughtful attention, and are undoubtedly well able to judge.

1 "This used to be my wish: a bit of land,
A house and garden with a spring at hand,
And just a little wood. The gods have crowned
My humble vows; I prosper and abound."
Hoc erat in votis — Sat. VI. B. II.

. . . .

"The farmer dragged to town on business, swears
That only citizens are free from cares." — *B. I. Sat. I.*

. . . .

"And courts and levees, town-bred mortals' ills,
Bring fevers on and break the seals of wills."
Quumque dies tibi pollicitus.
John Connington's *Horace*, 12°, Lond., 1872.

2 "Strange! there should be found,
Who self-imprisoned in their proud saloons,
Renounce the odors of the open field
For the unscented fictions of the loom;
Who, satisfied with only pencilled scenes,
Prefer to the performance of a god." — *The Sofa.*

. . . .

"God made the country, and man made the town,
What wonder then that health and virtue, gifts
That can alone make sweet the bitter draught
That life holds out to all, should most abound,
And least be threatened in the fields and groves." — *The Task.*

"But though true worth and virtue in the wild,
And genial soil of cultivated life
Thrive most, and may perhaps thrive only there,
Yet not in cities oft; in proud, and gay,
And gain devoted cities. Thither flow,
As to a common and most noisome sewer,
The dregs and feculence of every land.
In cities foul example on most minds
Begets its likeness. Rank abundance breeds,
In gross and pamper'd cities, sloth, and lust,
And wantonness, and gluttonous excess.
In cities vice is hidden with most ease,
Or seen with least reproach; and virtue, taught
By frequent lapse, can hope no triumph there
Beyond the achievement of successful flight." — *Task.*

Among these, I may mention Dr. Nathan Allen of Lowell, Massachusetts; Dr. J. M. Toner of Washington, D. C.; Dr. John S. Parry[1] of Philadelphia, and the late lamented Dr. Hunt,[2] President of the London Anthropological Society.

These men are all habitually careful, thoughtful, and moreover, conscientious in the expression of their opinions; and we are forced to accept the weight of their evidence, however humiliating, as regards our future prospects as a nation.

Dr. Parry believes that "it may yet become a serious question, whether the Anglo-Saxon race is adapted for life in this country with its variable climate; and it may yet become a very serious question, whether the American will become a permanent nation, if immigration is cut off, for it is beyond doubt that though our people are not physically weak, the number of children born to native parents is small, and is decreasing every year. This is true not only of those families who have lived in this country for three or four generations, but it is more or less true of the immediate descendants of our Irish and German immigrants." I have shown in my article, "on the effect of nationality of parents on fecundity and proportion of sexes in births,[3] that foreign-born parents have a much higher degree of fecundity than native-born parents, and have as a consequence a larger proportion of male children.

If William Barton were living to-day, he would find his predictions of fertility, longevity, and increase of our people had fallen sadly short of his high hopes, as expressed in a letter to David Rittenhouse, dated March 17, 1791, "On the probabilities of the duration of human life in the United States of America.[4] He calls attention to the fact of the population having doubled in fifteen years; while at the present time it will take more than twice that length of time to increase the population to the same extent, and this is only eighty-two years ago.

He attributes this unparalleled increase to the early marriages,[5] virtuous habits, and simple manners of the people. The lack of large cities did not escape his notice, for he compares the unfavorable circumstances connected with city life with the healthful employments of the country.

Barton says that there were 138 deaths to every 100 births in Rome in the beginning of the eighteenth century; in Amsterdam, 171 deaths to every 100 births; in Berlin, for the five years ending 1759, 131 deaths to every 100 births. In London for twenty-six years, about the same time, 124.92 deaths

[1] John S. Parry, M. D., "Infant Mortality and the Necessity of a Foundling Hospital in Philadelphia." Papers of the Social Science Association of Philadelphia, 1871, pp. 28, out of *Penn Monthly*, — 1871.

[2] James Hunt, Ph. D. *The Influence of the Climate of North America on the Physical and Psychical Constitution*. Reviewed in No. 1, *Anthropological Review*, London, May, 1863, p. 18.

[3] *Philadelphia Medical Times*, December, 1873.

[4] Published in the *Transactions of the American Philosophical Society*, vol. iii. pp. 25 to 62, 1st Series (Philadelphia).

[5] William Penn, in a letter to his friends in England, says that there is scarcely a maid of nubile age unmarried in the Province of Pennsylvania — need I say how different it is now? How many men and women remain unmarried. — *Watson's Annals of Pennsylvania*.

to every 100 births; in Paris, for the fourteen years ending 1784, 97 deaths to every 100 births. In the city of Providence, R. I., during the sixteen years ending 1870, there were 915 births and 977 deaths of colored people.

With these fearfully high rates of mortality he compares that of places in our own country; among which are Salem, Mass., 1782-3, where there were but 49 deaths to every 100 births; the parish of Hingham, Mass., for the fifty-four years ending 1790, had 1,113 deaths, or 49.5 deaths to every 100 births. Of the deceased, 84, or 1 in 13.2, survived 80 years. At Milford, Conn., 1777, of the 239 persons who died, 1 in every 7 was upwards of 70 years of age, and 1 in 13 above 80 years. In Philadelphia, 1789, 1 in 40.8 of the persons deceased was above 80 years of age. In the years 1789-90 there were 49.94 deaths to every 100 births in Philadelphia. In 1789 there were 1,536 births and only 872 deaths. From 1861 to 1870 (ten years) there were 164,281 births, and 147,435 deaths, or 80.74 deaths to every 100 births in Philadelphia, which is more than double the proportion of mortality to births for the period above named, eighty-three years ago. In 1789 there was one birth to every 22 inhabitants; from 1806 to 1820 an annual average of 1 in 22.5; from 1820 to 1831, 1 in 22.6; from 1861 to 1872, only 1 in every 37.3. From 1806 to 1820 there was 1 death to every 47.86 inhabitants; from 1861 to 1870, 1 to every 39.1. The average duration of human life in Philadelphia near the close of the eighteenth century, was above twenty-eight years, now it is but 24.5 years.[1]

Notwithstanding the fact that the mean average duration of human life has decreased apparently 3.5 years in our city (though in reality more), yet, strange to say, there is one person in every 33 of those dying who attained to 80 years and above, among those dying from 1860 to 1872; while there is but 1 in every 38 in the period from 1820 to 1830, and only 1 in every 40.8 for the years 1789-90, — above the age of 90, however, there was a larger proportion in the earlier periods than at present.

The fact of there being a larger *proportion* of persons above eighty years of age among the decedents in recent enumerations than among those taken some years previous, has furnished a foundation in fact on which some exceedingly clever men have based erroneous conclusions, — among which I may mention the seeming inference that the *average duration* of human life has increased.

Now this fallacy happens in the following manner, viz.: A certain proportion of those dying in the extreme ages mentioned, are exogenous, having come to the city in late adult or advanced age, and though they contribute to swell the number, and consequently increase the proportion in extreme ages, yet their number is not sufficient to very materially affect, though falsely increasing, the mean average duration of human life, on account of the immense numbers dying in infancy and inferior ages. The reason that there was a larger proportion among the decedents of extreme ages in the decade from 1860 to 1871 than the decade between 1820-30, was because there was

[1] See further in the author's paper on "Statistics Relating to Births, Marriages, and Deaths in Philadelphia for the Eleven Years ending December 31, 1872." — *Penn Monthly*, September, 1873, pp. 24.

a larger proportion of persons of advanced ages coming into the city in the first named decade than in the last. In the ten years from 1860 to 1870, 91,674 persons, strangers from other places, took up their residence in Philadelphia, and by far the greater part of them were adults. This paradoxical contradiction is repeated in respect to the poor of cities, among whom, though the mortality be greater and the average duration of life less than among the rich, yet they have a larger proportion of decedents of extreme ages than the latter class.

In this connection, I cannot do better than quote the wise conclusion of Mr. George Harris, F. S. A., and vice-president of the Anthropological Institute. After mentioning the fact that the mean average duration of human life had increased from eighteen years during the century from 1500 to 1600, to nearly thirty-nine years from 1815 to 1826, he says: "Nevertheless, admitting all this, I must beg to suggest that it is clearly erroneous to contend that the increased average in the duration of human life affords any actual proof of increased longevity. All that it proves is, not that men are longer lived than they used to be, but that owing to increased attention to sanitary laws, they are less frequently cut off by diseases resulting from the neglect of sanitary precautions."[1]

This is one of the facts in evidence of the statement made in the beginning, — that too many of our people of advanced age retire to cities.[2]

Mr. Bollaert has given out some opinions "On the Past and Present Population of the New World," in the memoirs of the Anthropological Society of London, 1863, pp. 72–119, as also Mr. Walford on the population of the United States, in the London Statistical Society's proceedings, an examination of which, had we the time, would be useful in this connection.

Of the character of the exogenous population of towns, Dr. John Edward Morgan, in his paper on "The Danger of Deterioration of Race" from the too rapid increase of great cities,[3] says: "The country is robbed of a large portion of its productive population; men and women in the prime of their strength, when their chances of life are the most promising, emigrate to the towns, and then a comparison is instituted between the places they have deserted and those to which they have removed.

"The result of all such calculations must needs prove fallaciously favorable to towns."

Of the 101,486 emigrants from the industrial counties to London, 53,495 remain, or 1.4 per cent. Of the 587,143 persons going to London from the agricultural counties, 444,890 remain, forming 9.1 per cent. of the total population. Thus the exogenous population of London consists of persons from the agricultural districts, to the extent of 9.1 per cent., and from the industrial districts, to the extent of 1.4 per cent. of the entire population.

[1] "The Comparative Longevity of Animals of Different Species, and of Man," etc *Journal of the Anthropological Institute*, London, April, 1872, pp. 68–78, p. 78.

[2] Benjamin Franklin, in 1785 (?) published an article on the "Augmentation of the Human Species," in the *Gentlemen's Magazine*, but I was not able to find it in the volumes for 1785, owing perhaps to wrong date.

[3] Published in the *Transactions of the National Association for the Promotion of Social Science*, held at Sheffield (pp. 427–440).

Thus we find that it is not only persons who are in the prime of life, with families in many cases, preferring to remain in the crowded streets of towns, but others from the most vigorous class bring their delicate infants into them without fear of harm — and the acquisition of any considerable competence is a never-failing signal for city life, in those even who have been reared and made their fortunes in the country.

These changes of residence from city to country and the reverse, would seem to contribute to increase the mortality of both, if we may believe Dr. Nott, who says: "The citizen of the town is fully acclimated to its atmosphere, but cannot spend a single night in the country without serious risk of life; nor can the squalid, liver-stricken countryman come into the city during the prevalence of yellow fever, without danger of dying of black vomit."

The fault of over-crowding cities with idlers is a *mere matter of fashion.* In America it is the fashion to live in cities. In England it is equally the fashion to live in the country. Yet there is a reason for this fashion — and it is principally a matter of money. We Americans have not wealth enough to live in the country — though it may seem paradoxical to say that it costs more to live in the country than in the city — but I mean to live fashionably, which must always include a town house. In short, the people in America are utilitarians as yet, are too busy in making money, and have no time to do visiting at distances, and as a consequence country people would have no social life — their wives would have but one man to dress for, their daughters would languish in listless maidenhood, and their sons grow dull with *ennui.*

After a time, with more wealth, and when land is scarce and dear, it will become fashionable to have landed estates as the most solid and satisfactory investments. Thus, if not too late, we may reasonably hope that our citizens will be aroused to their interests and that of their posterity.

CONCERNING THE HEALTH OF INHABITANTS OF CITIES.

Sir John Sinclair [1] in his exhaustive work on "The Code of Health and Longevity," says: "The constitution of the generality of citizens may be denominated weak, irritable, and easily susceptible of diseased action; and when men are crowded together, to a certain degree, they engender diseases not only fatal to themselves, but which are contagious, and therefore destructive to others."

He concludes that residence in cities develops a nervous temperament, and when he sat in Parliament, counseled his countrymen to engage in agricultural pursuits, with a view of counteracting this tendency to a prevalence of the nervous temperament in the English people.

A French physiologist has said that the lymphatic temperament indicates or accompanies physical degeneracy, and ought therefore to prevail among old families in cities — and it may be that this will, some day, serve as an indication of ancestral antiquity and unappreciated excellence.

As a further evidence of more rapid physical degeneracy in great cities

[1] Sir John Sinclair, Bart., *The Code of Health and Longevity*, etc., etc., etc., in 4 vols. 8vo, Edinburgh, 1807, pp. 2271.

than in country districts, the *decline in stature* is a proof. Dr. J. Adams Allen [1] says: "In the United States the average height of persons bred and living in large towns and cities, is something less than that of those living in rural districts." This fact is so noticeable that it need not be attested by actual measurement.

Lord Bacon [2] says: "The country life, also, is well fitted for long life; it is much abroad and in the open air; it is not slothful, but ever in employment; it is without care and envy."

Dr. Price says: [3] "I have represented particularly the great difference between the duration of human life in towns and in country districts; and from the facts I have recited it appears, that the further we go from the artificial and irregular modes of living in great cities, the fewer number of mankind die in the *first* stages of life, and the more in the *last* stages. . . . . The greatest part of the black catalogue of diseases which ravage human life is the offspring of the tenderness, the luxury, and the corruptions introduced by the vices and false refinements of civil society. That delicacy which is injured by every breath of air, and that rottenness of constitution which is the effect of indolence, intemperance, and debaucheries, were never intended by the author of nature; and it is impossible, that they should not lay the foundation of numberless sufferings, and terminate in premature and miserable death."

MORTALITY OF CITIES.

I have stated that the mortality of cities was far greater than in the rural districts and small villages.

The duration of human life is shorter because of this great mortality. Infants and the very aged suffer most from the ill effects of city life.

In New York city, of the 365,508 deaths reported during the forty-nine years ending 1853, 50.49 per cent. were of children under five years of age. In Chicago, from 1843 to 1869, there were 63,538 deaths, 51.24 per cent. of which were of infants under five years of age. Mr. Martin, a member of the Health of Towns Commission, says it is reckoned that out of 1,000 births, 221 only die under five years of age in agricultural districts, while no fewer than 385 die annually, under the same age, in closely built up towns.

In Philadelphia, I have found that 28.5 per cent. of the total mortality was from deaths of infants one year and under; 8.5 from one to two years; 8.3 per cent. from two to five years of age; or 45.3 per cent. were under five years of age. During the twenty years ending 1827, only 39.8 per cent. of the total mortality was from children under five years of age, — yet we are often told that the health of cities is improving and human life is increased.

Dr. Toner, in his excellent paper [4] on "Free Parks and Camping Grounds; or Sanitariums for the Children of Cities," says: "The healthfulness of the country as compared with the cities, is in such marked contrast in this

[1] *Medical Examinations for Life Insurance*, Chicago, 1867, 8vo.
[2] On Life and Death. Part 49.
[3] *Reversionary Payments*, p. 371.
[4] *Northwestern Medical and Surgical Journal*, Nov. 1872.

respect, that instead of the percentage of all deaths being greater under five years of age (than of those dying above five years), as in cities, the percentage is largely reversed; and even when the whole annual mortality of the United States is considered in the aggregate, the small mortality among children in the rural districts is sufficient to overcome the unfavorable reports of cities." Mortality of children under five years, in Sheffield, England, 1863, 61 per cent. of total mortality; in 1864, 53 per cent.

In conclusion he states it as his belief "that a considerable percentage of the infantile mortality of cities could, under favorable circumstances, be prevented, is the settled conviction, not only of physicians, but of the parents of these innocent victims."

The most trying time for children in cities is during the intensely hot weather of the summer months, as may be seen from an examination of Doctor Russell's comments [1] on the dreadful mortality of children in New York city, for the week ending July 6, 1872. During this week there were 1,591 deaths in all, 229 more than ever before registered; 1,007 or 63.2 per cent. of these were children under five years of age; and 45 of persons above seventy years of age. Of 1,007 infants under five years of age, who fell victims to diarrhœa, 499 were under one year, and 604 under two years.

The total mortality from diarrhœa was 653, or 41 per cent. of the deaths from all causes. Of the 2,351 deaths from all causes in the month of July, 140 were of diarrhœal affections, and 102 of diseases of the nervous system.

Intense heat, bad food, and foul air appear to be the principal predisposing causes to this extraordinary mortality. The "Free Camping Grounds and Sanitariums," recommended by Dr. Toner, are assuredly worthy of consideration in this connection, as offering a means of obviating a large part of this extraordinary mortality.

That this high rate of infant mortality is not unavoidable, we have a practical proof in the result of the efforts of the Paris Society for the protection of infant life. Out of the 1,682 infants committed to its care during the ast year, the Society only lost 60, or less than four per cent., while the mortality among infants put out to nurse in the provinces is about sixty per cent.

Diseases of the lungs are twice as fatal in great cities as in the country; diseases of the nervous system $5\frac{1}{2}$ to 1; of the digestive system, $2\frac{1}{2}$ to 1; of children by epidemics, fourfold; and of convulsions, tenfold.

Dr. Farr asks whether this excessive mortality of cities is inevitable.

Some sanitary reformers, and among them Mr. Chadwick, believes that cities can be made as healthful as rural districts, but this is evidently beyond a possibility; and Mr. G. L. Saunders, in his paper [2] on "The Death-rate of Rural and Urban Districts," very wisely says: "The loss of lifé must be — until perhaps the millennium — considerably greater in urban than in the rural districts."

Lord Stanley, in his address before the National Association for the Promotion of Social Science, 1857, pointed out that in 134 thickly inhabited

[1] *New York Medical Record*, p. 333, 1872.

[2] Transactions of the National (British) Association for the Promotion of Social Science, 1865, pp. 452–459.

districts where the higher rate of cholera mortality occurred, the population was 915 to the square mile; in 404 districts having a lower mortality, there were but 235 inhabitants to a square mile; in the remaining 85 districts there were no cholera deaths, and there were but 122 inhabitants to the square mile.

According to the Registrar General's Report, of the inhabitants of England and Wales, 8,250,000 persons live on 2,150,000 acres, constituting the urban population, or 3.8 persons to the acre. Among these the death-rate was 25 per 1,000 living. The remaining 9,750,000 live on 350,000,000 acres, or 1 person to every 35 acres; these constitute the rural population, and have a death-rate of 17 per 1,000, giving a difference of 8 per 1,000 in favor of the country.

In ten crowded cities there are 1,165,530 inhabitants living on 33,551 acres, or 34 per acre, with a death-rate of 28 per 1,000 living.

In twelve smaller places, 238,595 acres are occupied by 128,934 persons, or 1.8 acres to each person, with a death-rate of 21 per 1,000.

In sixteen still smaller places, 217,282 persons live on 1,214,977 acres, or 5.5 acres to each person, with a death-rate of only 16 per 1,000.

In one district of Northumberland, 1 person to 10 acres, with a death-rate of 15 to 1,000. In another district of this county there were 21.5 acres to each person, with a death-rate of 14.02 per 1,000.

In Liverpool there are 108 inhabitants to the acre, with a death-rate of 36 per 1,000.

In London there are 42 persons to each acre, varying from 7 to 429.

In the fourth ward of New York city there are 183,000 persons to the square mile.

These facts point to over-crowding in cities as a cause of the excessive mortality occurring in them, though there would appear to be more definite causes accompanying this which seem to be operative; for Dr. Robert Martin, after careful investigation, believes the death-rate of Liverpool was raised from 25 in 1,000 in 1860, to 50 in 1,000 in 1866, on account of the evils attending intemperance, owing to great development of the licensing system.

Dr. Morgan attributes the greater mortality of cities than rural districts, to foul air, constitutional syphilis, and intemperance. To these might be added, irregular hours, want of exercise, sensual appetites gratified; and unhealthy and extra-hazardous occupations.

The death-rate among persons under fifteen years is, in

Liverpool	48.5 in 1,000 living.
Manchester	42.5 in 1,000 living.
Birmingham	39.0 in 1,000 living.
London	33.0 in 1,000 living.
Berks, Dorset, and Westminster . .	18.5 in 1,000 living.
Wiltshire	18.0 in 1,000 living.
Of all ages in 27 agricultural districts (1861–2),	21.4 in 1,000 living.
Of all ages in the 4 chief cities . .	40.7 in 1,000 living.

"To live in the country and in small towns is favorable to longevity; to live in great towns is unfavorable. In great cities, from 1 in 25 to 1 in 30

die every year ; in the country, from 1 in 40 to 1 in 50. Mortality among children is in particular much increased by living in great cities, so that one half of those who are born, die generally before the third year ; whereas, in the country, the half are not carried off until the twentieth or thirtieth. The smallest degree of human mortality is 1 in 69 annually ; and this proportion is found only here and there among country people."[1]

"According to the Registrar General's report on the mortality of children, nearly one half of all that are born alive die before the end of the *fifth* year in Liverpool ; while the same number in London live to the age of thirty-three ; and in the county of Surrey to fifty. In 1845, nearly one half of all the children born in Birmingham, died under *five* years of age ; the entire half in Manchester died in the same period ; and more than one half in Liverpool. In London the proportion was between one half and one third ; and in Wales less than one third."[2]

Sussmilch[3] supposed that the mortality of the country was 1 in 35, 1 in 49, 1 in 50, and even 1 in 100. He estimates small cities 1 in 25 to 1 in 28 ; and of great cities 1 in 24 to 1 in 20. Graunt[4] estimated that the mortality in the city exceeded that in the country by 1 in 12. Friedlander calls attention to the fact, that many of those whose names are inscribed on the roll of births in the country and small villages, often augment the bills of mortality in great cities, thus favoring the city mortality by the acquisition of inhabitants who have passed the critical period of infancy in the country. Price observed that a fourth of those who die in London were not born there, and that it took ten thousand individuals from other places to cover the deficit between the births and deaths.

LONGEVITY.

The lower mortality of rural districts would indicate a greater longevity, which is always realized, where any calculations have been made.

The mean average duration of life in the eastern districts of London was from twenty-five to thirty years, in the northern and western districts from forty to fifty years.

In 1,000 deaths in the country districts of England, 202 persons attained the age of seventy years. In Liverpool but 90 attained to the same age, and this too, in the face of the fact of the larger part of the exogenous population coming into the city after the dangers incident to infancy are past. The average age at death in Rutlandshire was thirty-eight years ; in Liverpool, twenty-seven years.

Taking the same population, it has been shown by the Registrar General that in four years a greater number died in town districts than in country districts, by 99,752.

Out of 750,322 deaths in London from 1728 to 1758 (thirty years), only 242 persons survived the age of one hundred years.

[1] Christopher William Hufeland: *Art of Prolonging Life.* Edited by E. Wilson. Boston, 1854, p. 102.

[2] Ibid. Note by Erasmus Wilson. p. 103.

[3] *Dict. des Sci. Med.*, Art. "Mortalité," v. 34, p. 375.

[4] *Natural and Political Observations on the Bills of Mortality*, London, 1759, 4to.

In agricultural districts 20.7 in every 100 living attain forty-five years; in the four great cities, only 17.5.

The average age at death in the State of Rhode Island [1] from 1858 to 1870 (including Providence), was 31.45 years. In Providence,[2] the largest city, during the fifteen years ending 1870, there were 16,203 deaths, and the average age of decedents was 27.09 years; leaving a difference of 4.36 years in favor of the rural districts.

The unhealthfulness of various callings in towns as compared with the country may be inferred from the following from Dr. Morgan's paper: —

London.		Hertfordshire.	
Class.	Average Age at Death.	Class.	Average Age at Death.
Gentry	44	Gentry	45
Tradesmen	25	Farmers	47
Mechanics	22	Laborers	39
Average	27	Average	40

Dr. Price [3] says the expectation of a child just born in the parish of the Holy Cross, near Shrewsbury, is 33.9 years; in Northamptonshire, 25½; in Norwich, 23¾; in London, 18. In Holy Cross parish one in eleven die at 80 years and upwards; in Northamptonshire, one in twenty-two; in Norwich, one in twenty-seven; in London, one in sixty.

In the United States (1860), there was one death to every 78.32 inhabitants; in 1870 one to every 79.77; while in New York city (1870), there was one death to every 39.3 inhabitants. In Philadelphia, 1861 to 1871, one death to every 39.1 inhabitants. General Walker [3] gives the mean average duration of human life in the United States (1870) at 39¼ years, while in New York and Philadelphia it is only 23 years, or 16 years less.

Dr. Farr, in his first annual report (1839), says that out of 1,000 deaths in England and Wales, 145 had attained seventy years and upwards.

210 in thinly peopled districts of W. Riding of Yorkshire and Durham.
198 in Northumberland, Westmoreland, and Lancashire.
196 in Norfolk and Suffolk.
192 in Devonshire.
188 in Cornwall.
104 in London and suburbs.
81 in Birmingham.
79 in Leeds.
63 in Liverpool and Manchester.

[1] Dr. E. T. Caswell's Report, 1871, p. 70. [2] Dr. Edw. M. Snow's Report, 1870, p. 28.

[3] Richard Price, D. D., *Observations on Reversionary Payments, Annuities, etc.* London; 5th edition, 1792, 8vo.

[4] General Walker, in his address before the American Public Health Association, Nov.

According to the statements made in the fifth annual report (1843) of the Registrar General, of the persons aged from forty to sixty years, there were living in

Exeter	13.28 per cent.	Liverpool	14.87 per cent.
Sheffield	15.50 per cent.	Manchester	5.43 per cent.
Birmingham	15.15 per cent.	Leeds	15.23 per cent.

In the following four agricultural districts, —

Devon	16.97 per cent.	Essex	16.27 per cent.
Norfolk	16.50 per cent.	Suffolk	15.98 per cent.

"Can anything," says Dr. Farr, "display the different effects of rural and town life, on longevity, more uniformly, more regularly, or more strikingly?"

It seems to be a universal law, says Dr. Edward Jarvis,[1] that condensation of population lessens the chances of life. The ratio of mortality is greater in the city than the country, and this increases as the people live nearer together in the city. From his admirable paper on "Infant Mortality," we take the following: —

The Registrar General [2] of England gives a table showing the number of deaths in 10,000 living, and average number of people to an acre of land, in each of the six hundred and twenty-three districts of England and Wales.

In the districts which had 100 to 250 persons to the acre, the annual deaths were 262 in 10,000 living.

In those which had one to two acres to each inhabitant, the deaths were 214 in 10,000. In thirty settled districts, with twelve or more acres for each, the deaths were only 168 in 10,000.

In cities the mortality increased with the crowding of the living, as shown by the reports of deaths in the four places below: —

Town.	Living to Square Mile.	Annual Deaths in 10,000 Living.
London	50,000	251
Leeds	87,256	272
Manchester	100,000	337
Liverpool	138,000	348

The excess of mortality falls in greater proportion on childhood than on maturity.

The deaths in the healthiest districts were 10,604 in 100,000 children under one year. In Westmoreland and North Wales, they were 11,884. In fourteen city districts, 25,858. In Liverpool, 28,005.

The annual deaths under five in the period 1849–1853 were, in thirty cities, 338,000, and in healthy country districts 135,478, in the same population in each. As often as 100 died in the healthy country, 250 died in the city, among the same number living.[3]

12, 1873, said that he estimated the deficit in the returns of deaths in the census of 1870, a thirty-three per cent.

[1] *State Board of Health of Massachusetts Report,* 1873, p. 224.

[2] *Twenty-fifth Report,* pp. xxxviii to lviii.

[3] *Registrar General's Reports,* xxv., p. xxvii.

The life-table, founded upon the most rigid observations, makes the proportion of deaths of children to be 5.29 per cent. for the country, and 13.34 in the city, or as 100 to 252.

The reports of births and deaths of Scotland, make three divisions of the people.

1. Those living on the islands.

2. Those living in the country of the mainland.

3. Those living in the great cities.

During the fourteen years reported, the proportion of deaths of children for every hundred births in each class were : —

Division.	Under One.	Under Five.
Islands	8.05	15.58
Mainland Country	9.80	18.26
Great Cities	14.91	30.90

As often as 1,000 died on the islands, 1,217 died on the mainland country, and 1,852 in the cities under one; and 1,172 in the rural, and 1,983 in the city districts under five.

There are similar differences in France. The deaths in 1861 to 1865, were less than 12 per cent. in two departments; less than 15 per cent. in six; less than 17 per cent. in nine departments, and 39.07 per cent. in Paris, in the same number living under one year.[1]

A chart recently published by Bertillion, in France, shows the different rates of mortality of children under one and under five in each department. In the department of the Seine, which comprehends Paris, the rate of infant mortality is 268.6 in 1,000; while seven of the neighboring departments have a mortality from 277 to 359 in 1,000. Dr. Jarvis explains the apparently favorable mortality of the city, by calling attention to the fact of children being sent into the country and swelling, in this way, the mortality in the latter to the advantage in the former.

In 1863 the Public Administration of Charities, in Paris, had charge of 22,829 infants; 17,759 of these were sent into the country, and there 1,359, or 7.65 per cent. died; 4,397 were retained in the city, and 469, or 10.6 per cent. died.

Dr. Berg, the chief of the Royal Statistical Bureau of Sweden, says: "The difference between the towns, especially the large towns, and rural districts, has an important effect on the mortality of children of that country."

Dr. Herz makes the same report of Austria. And records of mortality of other European nations give similar accounts.[2]

"In the least unhealthy rural districts of England, the death-rates of children, in the first year, are not more than one in twelve or fourteen. In the

[1] *Mouvement de la Population*, 1861–65, p. lxvii.

[2] *Journal of the Statistical Society of London*, March, 1866.

least unhealthy urban districts, there dies one in eight or nine, in the first year. In Manchester, one in five dies, under one, and one half of all that are born there, are dead, soon after their fifth year. But in Berlin, Prussia, one out of every three dies within the first year, and one half of all that are born there, are dead within two and a-half years after their birth. In 1871, 31,262 children were born, and 10,072, or 32.2 per cent., died within that year."[1]

In New York city[2] in 1871, there died 10,701 children less than two years old, or 39.6 per cent. of the total mortality, the per centage in 1870 having been 40.8 per cent. The mortality of children less than five years of age amounted to 12,791, or 48 per cent. of total mortality.

In Philadelphia, for the years 1870–1–2, the deaths of children under one year constituted 27.77 per cent. of total mortality; under five years 43.66 per cent.[3]

In Massachusetts for the ten years, 1860–1870, Dr. Edward Jarvis has tabulated the following facts, in which he compares the infant mortality of Boston with that in thirteen other and smaller cities in the State, and finally with the remainder of the State at large.

	Births.	Deaths under One.	Ratio of Deaths under One, to Births.
Boston	60,354	11,537	19.11 per cent.
Thirteen other Cities	80,088	13,863	17.30 per cent.
Rest of State	198,030	24,547	12.39 per cent.

The rate of infant mortality, in comparison with the births, in the thirteen smaller cities (towns) exceeded that of the open country by 39.60 per cent., and that of Boston had an excess of 54.23 per cent. Among the same number of children, born in each of these classes of places, as often as 1,000 died in the country, 396 died in the smaller cities, and 1,542 in Boston, under one year.

Dr. Farr[4] gives the following as the proportion of deaths under five years of age, occurring in London for the years named: —

1730 to 1749	74.5 per cent.
1770 to 1789	51.5 per cent.
1851 to 1870	29.8 per cent.

"So great was the rate of infant mortality in London, that an Act of Parliament was passed in 1767, ordering that all parish infants should be nursed six years in the country. Before this almost all parish children died in their first six years."[5]

The advantage of the system of nursing in the country, already alluded to as practiced in Paris, was shown in this latter place, to have reduced the mortality from 10.6 per cent. to 7.65.

1 Edwin Chadwick, in *Journal of Society of Arts*, London, Dec. 20, 1872, p. 87.
2 *New York Medical Record*, Dec. 1, 1873.
3 *Reports of Board of Health*, 1872, pp. 20.
4 In Macculloch's *Statistical Account of the British Empire*, ii., p. 543.
5 Price's *Annuities*, ii., 32.

The mortality of great cities is found to be both in this country and in Europe more than twice as great as that of the rural districts; indeed, it is fully $2\frac{1}{2}$ times as great, for the cities are counted with the country in those comparisons, thus reducing the difference in their favor, and moreover, the mean average age at death in cities is falsely increased by the fact of their the exogenous population of towns having passed the most critical period of lives in the country.

In England it is found that 50 per cent. of the inhabitants are between the ages of 15 and 45 years, while in the agricultural counties there are but 42 per cent., hence there are 13 per cent. more persons of a marriageable age in cities than in the rural districts. Of these, however, it is probable that a majority are females.

On inquiry into the causes of the greater mortality of cities than rural districts, we find that circumstances connected with poverty are most noticeable, for in Philadelphia during the ten years ending 1871, I found that there was but one death to 57 inhabitants in the richest ward, though not exclusively inhabited by that class, and one death in every 42 inhabitants in the next richest ward, while there were but 36.50 inhabitants to every death, in the poorest ward, and there were but 4.86 persons to each family and 5.04 persons to each house, here; while there were 6.23 persons to each family and 7.04 inhabitants to each house in the richest ward.

Villot, in Paris, 1830, found that there was one death to every 42 inhabitants in the richest arrondissements, and one in 25 in the poorest. Of 100 infants born alive to the gentry of England (1844), there died 20; to the working classes, 50. In the aristocratic families of Germany there died in five years, 5.7 per cent.; among the poor of Berlin, 34.5 per cent. In Brussels, the mortality up to the fifth year was six per cent. in the families of capitalists, 33 per cent. amongst the tradesmen and professional people, and 54 per cent. amongst the workingmen and domestics. De Villiers found the mortality among the workingmen of Lyons 35 per cent., and in well-to-do families and agricultural districts 10 per cent.

Dr. Edward Jarvis has also noticed that "there are differences in the same city. In four of the districts of London the deaths under five were from 50 to 59; and in four other districts these rates were from 101 to 108 in 1,000 living, of the same age. Between these extremes, there were all intermediate grades of mortality in other districts. This is due in part to the different densities of the population, and in greater degree, to the differences in their domestic condition.

Similar differences were found in Boston, in 1870, the year of the census. The State Board of Health divided the city into twenty-four districts, according to their sanitary condition. Some of these were low and wet, others were hilly and dry. Some were laid out with wide streets, open grounds, broad sidewalks, and were inhabited by the wealthy and comfortable classes. Others were filled with narrow streets, lanes, and courts, and in these were crowded the dwellings and families of the poor. In the most favored districts, the deaths of infants under one, were 86, 100, 167, 171, in 1,000 living

at that age. In the unhealthy districts, the mortality was 359, 379, 409, and 486, in the same number of living infants.[1]

Dr. Marc D'Espine,[2] a Swiss writer of note on mortality, says: —

"Wealth and comfortable circumstances increase vitality and longevity. They raise the mean average of life. They lessen the mortality at all ages, and especially in infancy. But poverty and misery have the contrary effects."

According to Dr. Jarvis,[3] Mr. Chadwick, in his report on the sanitary condition of the laboring classes (page 161) says, that he found in fourteen cities and districts that the average age, at death, of 1,232 members of the most comfortable classes, including the children and infants, was 44 years. Of 5,035 persons in families less comfortably circumstanced, it was 27.47 years, and 20,385 persons in families of the poor, had enjoyed an average life of only 19.58 years. The average longevity in the most favored class exceeded that in the poorest by 125 per cent.

The difference was most in the deaths of the children. Compared with the number living under one year, the deaths were 20 per cent. in the last, 44.4 per cent. in the middle class, and 50 per cent. in the poorest.

In Massachusetts,[3] the proportion of deaths under two years in the families of farmers who owned their farms, was 11.94 per cent. of those of all ages, and in the laborers' families, the proportion was about double, or 23.5 per cent.

THE RELATIVE INFLUENCE OF CITY AND COUNTRY LIFE ON MALES AND FEMALES.

One of the most curious facts in connection with the relative longevity of the sexes is the influence of country and city life. Women are longer lived in cities than in the country, while men are longer lived in the country than in the city, as may be seen by the following: —

Quetelet says, that "the prosperity of the state ought to consist less in the multiplication than in the conservation of the individuals of which it is composed."

This authority finds the mortality in cities in Belgium, as compared with country districts, as 4 to 3.

After birth, according to Quetelet, the probabilities of life in Belgium are as follows: —

Locality.	Males.	Females.
In Cities	21 years.	28 years.
In Country	24 years.	27 years.
At Five Years in Cities	48 years.	51 years.
At Five Years in Country	51 years.	48 years.

The probability of life reaches its maximum at five years.

[1] Dr. Jarvis, *Report of State Board of Health of Massachusetts*, 1871, p. 350.
[2] *Annales de Hygiene, etc.*, tome xxxvii. p. 325.
[3] *Report of State Board of Health of Massachusetts*, 1873, pp. 214-16.

In the population of Belgium there were 91.14 males to 100 females in the cities, and 99.42 males to 100 females in the country districts. Among the deaths there were 101.45 males to 100 females in cities, 99.20 males to 100 females in country districts. There is, therefore, an excess of more than five per cent. in the deaths of males over females in the cities, while the proportion of the sexes among the deaths in the country is scarcely different from that in the living, in the general population.

In the State of Rhode Island (1871) [City of Providence excluded], the average age of female decedents was 32,35 years, while the average age of this sex in the largest city (Providence), was 37.92 years.

I have stated in another place, that the number of still-births and the proportion of males in such cases, was greater in the country (the excess amounting to 9.3 per cent. in Belgium) than in the city. This is in some degree, due to the greater fecundity and larger number of male conceptions in the country districts over cities ; but there are other causes to which the death of a larger proportion of the difference between the mortality from this cause in cities over the country is due ; and principal among these I would suggest the delay and lessened facilities for calling in a practitioner, and less skillful obstetrical aid, afforded to the parturient woman and her issue. Seeing that the proportion of males among still-births [1] is greater in the country, and as this condition of the child is usually attended with greater danger to the mother, we are not surprised to find greater mortality among women of a child-bearing age in the country than in the city. Whether the greater mortality of females of all ages in the country than in the city is principally due to this cause, I am not prepared to state, but I am persuaded it is not.

In the State of Michigan (1870), there were 10,766 deaths, 150 or 1.3 per cent. of which were recorded as occurring among women in childbirth. In Philadelphia, for the eleven years ending 1870, there were but 93 deaths registered from this cause, or .053 per cent. of total mortality ; of these, one was from 15 to 20 years of age ; 43 were from 20 to 30 ; 41 were from 30 to 40 ; 8 were from 40 to 50 ; average age of all at death, 31.05 years.[2] In Rhode Island (1871), there were 27 deaths in childbirth, or .808 per cent. of the whole mortality ; in Providence, the principal city in the State, only .567 per cent. of total mortality was from childbirth. According to the United States census for 1870, the deaths from childbirth, abortion, and puerperal convulsions numbered 4,810, or .977 per cent. of total mortality. In 1860, 4,066 women died from these causes, or 1.033 per cent. of total mortality. In 1850, 3,117, or .965 per cent. of mortality. Quetelet has shown, in the fol-

[1] The proportion of children stillborn in the chief cities of Europe is one in every twenty-two births, the number being three times greater among illegitimate than legitimate children. In France, 1850, one in 37 were stillborn ; in Paris, one in 12.5 ; in Great Britain, one in 20 ; in Philadelphia, 1860–70, one in 21.7.

From the larger proportion of still-births in cities over country districts, we might infer that citizens have a lower initial vitality or viability than those born in the country.

[2] From the author's paper on "Deaths from Cancer and some of the Diseases peculiar o Women in Philadelphia, for the Eleven Years ending 1871," *Journal of the Gynæcological Society of Boston*, September, 1872, pp. 201–204.

lowing table on the influence of the sexes on the deaths at different ages, that from the fourteenth to the fiftieth year of age, or during the child-bearing period, in cities, 1,025 females die for every 1,000 males. While in the country, 1,215 females die to every 1,000 males during the same period. In this same table, which we give below, in cities, from 50 to 100 years of age, 1,185 females die for every 1,000 males, while in the country, there are only 972 females to every 1,000 males attaining these ages. In Belgium, where the calculations were made, there are in the population of all ages, 1,098 females to 1,000 males in cities, and 1,006 females to 1,000 males in the country districts. There is scarcely a single city of any magnitude, in which the female population is not in excess of the male, though there be an excess of from two to six per cent. of males in the births. The proportion of females in the population of cities, as well as in the births, is nearly always greater than in the surrounding country. To this greater excess of females in cities has been attributed, among other causes, the larger proportion of illegitimate children in them than in the rural districts.

Table showing the Influence of the Sexes on the Deaths at different Ages in Belgium.[1]

Ages.	Deaths of Females for one Male Death.	
	In the Cities.	In the Country.
Still-born	0.75	0.59
From 0 to 1 month	0.75	0.73
From 1 to 2	0.73	0.84
From 2 to 3	0.82	0.83
From 3 to 6	0.79	0.86
From 6 to 12	0.94	0.97
From 1 to 2 years	0.94	1.03
From 2 to 5	1.00	1.06
From 5 to 14	1.12	1.07
From 14 to 18	1.22	1.34
From 18 to 21	1.02	1.08
From 21 to 26	0.79	0.90
From 26 to 30	1.00	1.17
From 30 to 40	1.14	1.60
From 40 to 50	0.98	1.20
From 50 to 60	0.93	0.85
From 60 to 70	1.04	0.95
From 70 to 80	1.30	1.00
From 80 to 100	1.47	1.09
	.9857	.1008[2]

[1] Quetelet, *Sur la Reproduct.*, *Mortal.*, etc., 1832, p. 68.

[2] 101.45 males to 100 female decedents in cities; 99.20 to 100 in country.

MARRIAGES AND BIRTH-RATE.

The marriage rate in the four chief cities of England, 1860–61 was,	13.6 in 1,000 living.
Birth-rate, 1860–61	35.5 in 1,000 living.
Marriage-rate in the country	7.0 in 1,000 living.
Birth-rate in the country	31.5 in 1,000 living.
In Manchester, in 1860–61, the marriage-rate was	18.5 in 1,000 living.
Hertfordshire, in 1860–61, the marriage-rate was	5.8 in 1,000 living.
Manchester, 1860–61, the average birth-rate was	37.5 in 1,000 living.
Hertfordshire, 1860–61, the average birth-rate was	30.5 in 1,000 living.

Hence, "while marriages in the city were nearly fourfold more numerous than in the country, the births there only exceed the latter by about one sixth."[1]

In the Parish of Hingham, Massachusetts, before 1789, according to Mr. William Barton, there were 2,247 births, or 6¼ births to each marriage. Dr. Nathan Allen believes that there are scarcely more than three births to each marriage in that State at the present time.

I have found[2] that there were 3.91 births to each marriage annually in Philadelphia in 1861, while there were only 2.67 to each marriage in 1870, or an average of 2.6 legitimate births to each marriage annually, from 1861 to 1871. There were 101 persons to each marriage annually during this latter period.

Villermé of Paris, contended that the restrained fecundity in his city was due to the will of the inhabitants, rather than to actual physical degeneracy, but the greater proportion of males in births in country districts than in cities, and the greater mortality of the latter, fully disproves this theory.

It is said that it is impossible for three successive generations to survive who have lived continuously in London; and it is certainly true that an uninterrupted residence of two hundred years in a great city, by a family who intermarry with others not less old, must result in its extinction.

One of the noble families of England, recognizing this fact, has adopted the rule of marrying the sons to the rural gentry or others of inferior rank, that there may be greater certainty of perpetuating the name in the male line. Indeed, I am credibly informed that in England, so great is the desire for issue, that marriages are too frequently postponed until this is assured.

Wealthy citizens who desire to perpetuate their names in succeeding generations of sons, should marry vigorous, healthy country women.

I have shown in another paper, on the "Effects of Nationality of Parents on Fecundity,"[3] etc., that foreign mothers with American fathers, have a larger number of children than where the nationalities of the parents are reversed.

PROPORTION OF THE POPULATION LIVING IN CITIES.

In England during the last one hundred and fifty years, the population of

[1] John Edward Morgan, M. A., M. D., Oxon. "The Danger of Deterioration of Race from the too Rapid Increase of Great Cities," *Transactions of the National* [*British*] *Association for the Promotion of Social Science*, 1865, pp. 427–449.

[2] The Author's Statistics of Philadelphia, etc., *Penn Monthly*, September, 1873, pp. 24, and papers of Social Science Association of Philadelphia.

[3] *Philadelphia Medical Times*, December, 1873.

country districts has decreased, from having 74 per cent. of the entire population to having but 44 per cent.; the cities, therefore, have at the present time more than 56 per cent. of the entire population. From 1851 to 1861 towns and country districts increased at the rate of 3.9 per cent., while populous cities increased 17 per cent.

In the United States there were in 1860, one hundred and two towns with a population of 10,000 each, six between 11,000 and 12,000; four between 12,000 and 13,000; twelve between 13,000 and 14,000; seven between 14,000 and 15,000; three between 15,000 and 16,000; five between 16,000 and 17,000; three between 17,000 and 18,000; three between 18,000 and 19,000; two between 19,000 and 20,000; nineteen between 20,000 and 30,000; four between 30,000 and 40,000; six between 40,000 and 50,000; two between 50,000 and 60,000; four between 60,000 and 75,000; one between 75,000 and 100,000; one between 100,000 and 150,000; four between 150,000 and 200,000; two between 200,000 and 500,000; one above 500,000, and one above 800,000; in all 4,763,717.

In 1870 there was one city above 900,000; one above 600,000; two above 300,000; four above 200,000; two above 150,000; four above 100,000; four above 75,000; seven above 50,000; seven above 40,000; twelve above 30,000; six above 20,000; in all, fifty cities having each a population above 20,000, making a total of 5,074,849 inhabitants, or about one seventh of the entire population of the United States live in cities of above 20,000 inhabitants.

50 largest cities	1870	5,074.849
50 largest cities	1860	3,946,855
Increase of (22.2 per cent.)		1,127,994

At the present time fully fifteen per cent. of our population live in fifty cities, having from 20,000 to 1,000,000 inhabitants; or on an average of 101,496 persons to each.

Dr. Price calculated that London contained in the eighteenth century (1758), one ninth or 11.1 per cent. of all the people of England, and consumed from seven to ten thousand persons annually, who removed into it from the country, without increasing it.

Liverpool, Manchester, Bristol, Leeds, Sheffield, Hull, having a total population of 883,162 persons, had but 3,909 births in excess of deaths. Nine towns having a population of from thirteen to thirty-seven thousand, or a total of 227,870, had an excess of births amounting to 3,316, or nearly as many from about one fourth the number of persons.

Drowitch, with a population of 19,237, had an excess of 288, while Liverpool, with a population of 269,720, had only 152.

It is worth while for us to inquire whether there is any necessity for such a large proportion of those who do business in cities to live in them.

However much this may have been a necessity before the introduction of railroads, no such excuse can be offered at the present day; for every city, worthy of the name, has innumerable facilities for a residence in the salubrious air and quiet retreat of the country; and it is a matter of regret in view

of the facts here detailed, that a much larger number do not avail themselves of the splendid opportunities afforded in this direction. Particularly is this true of those who are raising families of children, among whom the mortality is so great in large cities. Notwithstanding this excessive mortality among children in cities, cutting off all the weakest, yet a far larger proportion, if not indeed, nearly all of our truly great men of the three learned professions, — of arts and sciences, and statesmen, from the presidents down — owe their superior excellence to their rural origin.[1]

In another place [2] I have said that *life is but developmental death*, and one reason citizens are shorter lived, — they live faster, develop more rapidly, and die earlier from this cause. It is well known that children reach puberty sooner in cities than in the country, and what is this but the evidence of the completion of one of the stages of development, — *life is therefore developmental death.* Life in cities is shortened, then, not only by disease, but by the circumstances connected with civilization, which favor and hurry on development, which finally culminates in death.

The reason of the excessive mortality among the poor, would appear to be due to improper preparation of, and scanty and inferior food, in addition to the evils of intemperance, inheritance, vitiated air, and over-crowding so commonly urged.

I am more than ever convinced of this since hearing Dr. Jarvis' excellent paper [3] on the importance of the proper preparation of food, and its influence on health, happiness, and longevity.

I cannot pass this point without also calling attention to Dr. A. C. Hamlin's (of Bangor, Me.) paper on "Alimentation Considered in its Relation to the Progress and Prosperity of the Nation." [4]

In 1749 the academy of Dijon proposed this question as a theme for their prize essay. *Has the restoration of the sciences contributed to purify or to corrupt manners?* The famous Rousseau was one of the fourteen competitors, and in 1750 his discussion of the academic theme received the prize. This was his first entry on the field of literature and speculation, and laid the foundation of his far-famed future.

John Morely [5] says: "People have sometimes held up their hands at the amazing originality of the idea that perhaps the sciences and the arts have not purified manners. This sentiment is surely exaggerated, if we reflect first, that it occurred to the academicians of Dijon as a question for discussion; and second, that, if you are asked whether a given result has or has not followed from certain circumstances, the mere form of the question suggests no quite as readily as yes."

1 In answer to a letter of inquiry on this point from Dr. S. Austin Allibone, the distinguished author of *The Dictionary of English Authors*, he says: "though I do not venture an opinion," yet "*a priori*, I should think your theory correct."

2 "A New Theory concerning the Cause of Enlargement of the Prostate Body (Gland); ascribing it to Developmental Causes." — *Philadelphia Medical Times*, January, 1874.

3 "The Power of the Housekeeper over, and Responsibility for, the Health of the Family," *Transact. of American Public Health Assoc.*, N. Y., 1874 (session of Nov. 11, 12, and 13, 1873).

4 Ibid.

5 *Rousseau*, by John Morely, 2 vols., London, 1873, vol. i. p. 132.

"Egypt, once so mighty, becomes the mother of philosophy and the fine arts, and soon after comes its conquest by Cambyses, by Greeks,[1] by Romans, by Arabs, finally by Turks. Greece twice conquered Asia, once before Troy, once in its own homes; then came in the fatal sequence the progress of the arts, the dissolution of manners, and the yoke of the Macedonian. Rome, founded by a shepherd, and raised to glory by husbandmen, began to degenerate with Ennius, and the eve of her ruin was the day when she gave a citizen the deadly title of arbiter of good taste. China, where letters carry men to the highest dignities of the State, could not be preserved by all her literature from the conquering power of the rude Tartar. On the other hand, the Persians, Scythians, Germans, remain in history as types of simplicity, innocence, and virtue." These are the words of Rousseau, in his reply to the King of Poland; and were he living to-day, he might safely say the same of France, the arbiter of good taste for the whole world, the most highly civilized people of the present time, physically and morally the weakest of nations, having a smaller population at the taking of the last census, than in the preceding.

History repeats itself, particularly where new nations ape the arts and luxuries of the old.

Luxury makes people indolent, pampers vices, leads to intemperance and debauchery with all their attendant evils. It saps the military virtues by which nations preserve their power and independence and renders immorality shameless.

Rousseau, in speaking of man, says: "This admirable creature, with foes on every side, is forced to be constantly on the alert, and hence always in full possession of all his faculties, unlike civilized man, whose native force is enfeebled by the mechanical protections with which he has surrounded himself. He is not afraid of the wild beasts around him, for experience has taught him that he is their master. His health is better than the health of us who live in a time when excess of idleness in some, excess of toil in others, the ease of irritating and satisfying our sensuality and our appetites, the heating and over-abundant diet of the rich, the bad food of the poor, the orgies, the excesses of every kind, the immoderate transport of every passion, the fatigue and strain of spirits — when all these things have inflicted more disorder upon us than the vaunted art of medicine has been able to keep pace with, since we quitted the simple, uniform, and solitary manner of life prescribed to us by nature."

Voltaire, on acknowledging the receipt of the second discourse of Rousseau, which was a kind of supplement to the first, said with his usual shrewd pleasantry: "I have received your new book against the human race, and thank you for it. Never was such cleverness used in the design of making us all stupid. One longs in reading your book to walk on all fours. But as I have lost that habit for more than sixty years, I feel unhappily the impossibility of resuming it. Nor can I embark in search of the savages of Canada,

[1] Bougainville, a brother of the navigator, said in 1760: "Greece is the universe in small, and the history of Greece is an excellent epitome of universal history." — Out of Egger's *Hellénisme en France*, ii. 272.

because the maladies to which I am condemned render a European surgeon necessary to me; because war is going on in those regions, and because the example of our actions has made the savages nearly as bad as ourselves; so I content myself with being a peaceable savage in the solitude which I have chosen near your native place, where you ought to be too." In conclusion, he says: "I am informed that your health is bad; you ought to come to set it up again in your native air, to enjoy freedom, to drink with me the milk of our cows, and browse our grass."

While I deny the anticipated results claimed by progressive transcendentalists, I equally disclaim all sympathy with the worst features of the iconoclastic natural perfectionists. And while it cannot be successfully denied, that advanced civilization and the congregation of immense numbers of people in closely crowded cities increases vice, immorality, and crime, — impairs health, shortens the duration of human life, and hastens the final extinction of the race, I cannot see how we could easily do without them, and should be the last one to attempt to devise plans to dispense with the comforts, the luxuries, the elegancies of city life. All of us willingly subscribe to the old motto — *Dum vivimus, vivamus* — while we live, let us live.

It is said that the deaths exceeded the births in London, by 10,000 annually, and this difference would be much greater were it not for the hundreds of thousands of strangers who annually take up their residence in this great metropolis. If this supply of sturdy strangers were cut off, London would rapidly decline in population; and indeed the same might with equal truth be said of any large city; none of them could keep up their population without recruits from outside.

If *all* the inhabitants of the globe were living in cities of the magnitude of London, and subjected to the same influences connected with the movement of population, the whole human race would become extinct in a century or two. And if you will imagine for a moment the entire human race living in a single city, little more than a century would suffice to annihilate the race.

Rome was not built in a day, but she grew apace and waxed strong, until the millions of souls encircled within her strong walls were only outnumbered by the broad acres comprehended within her empire. At one time this single city sat upon her seven hills, and ruled the world. And what became of this great empire, what caused her decay, decline, and fall? She was swallowed up in the *city* of Rome — too much civilization centered in a single city. The people were too much occupied with inconsiderable trifles, — effeminacy and brutality sapped her strength until she became a helpless victim to every foe. Professor Seelye in his lecture on Roman Imperialism says that Rome fell for want of men; the human harvest was bad, — it was a *physical*, not a moral degeneracy.

Thus it was with the city, founded on a myth, which rapidly rose to fame and good fortune, once the strength and fear of the whole world, and she fell without an adequate history, her language even dead, save as we hear it in the derived romance tongues; but thus it may be with any nation too much given to city worship. As a very recent example of this I need only

name France, — Paris had sapped her vitality by too much dilettante imperialism, until she became the easy prey of the sturdy German race. Too much civilization in Paris, the very centre of modern civilization, killed France.

Notwithstanding the fact that the mean average duration of human life was calculated, by Domitius Ulpianus, Prime Minister to Alexander Severus (year of Rome, 975; A. D. 222 to 235), to be thirty years, yet the mean average age at death in Philadelphia for the eleven years ending 1871, was less than twenty-four years, and in New York city still less. And these cities are both together not equal to Rome in numbers, and only two hundred years old. Who can tell what may be their condition in their nine hundred and seventy-fifth year? Does this indicate that they will equal Rome? Still, commercial interests rule to some extent the rise and fall of cities.

Large towns have been emphatically called the *graves of humanity*, and certainly they are not favorable to health and longevity. Indeed, they might be very properly compared to the fiery furnace, into which the condemned children were cast.

Those who would live to a good old age, and hand their names down through a numerous posterity in children endowed with rich mental gifts, should avoid the dangers of the great city and choose the country life.

It cannot be denied that cities are absolutely necessary for the fostering of the arts, the sciences, the elegancies of life, yet when they are so dearly bought, one cannot help the reflection, as he looks with wonder and admiration at these productions, of how many precious human lives they cost, of how many premature deaths, of how many souls are sacrificed on the altar of the arts.

The tender mother who has reared the helpless babe in the pure and quiet rural home, and watched it learn to walk and tell its name, studied the growth of character and development of feature, until budding into healthy, innocent manhood or womanhood; if she allow her offspring to choose the city as the field of their fortunes and fancies, with its sins and its syrens, its vices and its vanities, its ills and its iniquities, its pitiless poverty, though mingled with elegance and luxury, with indolence and ease, its follies and frivolities, so attractive to us all, — I say if she loose him to all these without her guiding care, and have but little left, as is too often the case, but a misspent life, a wretched wreck, or an untimely death, well may she exclaim with the Roman poet, *Pericula mille sævæ urbis.*

SANITARY SCIENCE IN ITS RELATIONS TO PUBLIC INSTRUCTION.

By Hon. Andrew D. WHITE,

President of Cornell University.

You are well aware that it is not by virtue of any special claims as an investigator in sanitary science, or as a student in it to any great extent, that I now address you. But when I was invited to speak it seemed a good opportunity to make one more point in behalf of certain great, manly studies in our system of public instruction, and especially in our institutions for advanced instruction, and, therefore, an opportunity not to be neglected.

The generations that come after us will doubtless wonder at what this age has done, but I think they will wonder far more at what it has not done. There will be wonder at discoveries, inventions, reforms — at all our conquests in the realms of mind and matter; but I think the wonder will grow when notice is taken of the utter neglect in great systems of education, of the most important subjects which occupy us, either for material purposes or for mental and moral advancement. Look first at the neglect of political studies. Here is a great Republic, dependent, as all confess, upon the knowledge of those who live beneath its sway. And yet you may go from one end of the country to the other, and hardly find the slightest provision for any real instruction in Political Science, whether it be in political economy or political history. If during the War of our Rebellion, any thoughtful American wished to find out what that history was in which the germs of that great struggle were planted and developed, he had to go for such knowledge to the public lecture-room of Laboulaye at Paris, or the private lecture-room of Neumann at Berlin.

The case is still worse in regard to that great class of studies comprehended under the designation of Social Science. Every year our national legislature and some forty State and Territorial legislatures, and a vast number of county and town boards are brought face to face with the most vital social problems. They are called upon to make great expenditures for the prevention and cure of Pauperism, for the repression and punishment of Crime, for the treatment of Lunatics of various sorts, for the care of Idiots of various grades, for the special treatment of Inebriates, for the cure of the Sick in hospitals, for general measures of prevention as regards Epidemics, and yet no one will gainsay my assertion that on no subject are our legislatures and all our various bodies, so utterly blind as on this. If we look at the result of this as regards expenditure, the case is bad enough. The amount annually expended in all our States for this purpose is enormous.

The only approach which we have to the palaces of the Old World are in the various hospitals and prisons and asylums of the New. I can speak of this want of knowledge from personal experience. I can stand in the confessional on this subject. It has been my lot more than once to vote on such appropriations in a legislative body. I remember especially one case where the Legislature of this State was called upon to establish a great asylum at vast expense for a certain class of lunatics. The case was very pressing. A careful report from a commission showed that some provision of this sort must be made. A bill was passed, the buildings were erected, and yet when all was done, we were assured by an expert who had no interest one way or the other in the matter, that all our well-meant benevolence had, perhaps, resulted in almost as much evil as good, and that the whole institution was a failure as regards the immediate purposes for which it was erected. The simple cause for this, was that in that whole Legislature, in the lower House, in the upper House, in the Executive Department, there was not one person who had ever given any close attention to subjects of this kind, and we had been obliged to trust entirely to those who could give us scraps of information, no matter how crude. But if the immediate results are unfortunate, the remote results are still more so.

If any one wishes to see what vicious methods of dealing with great social questions will produce, he has only to look at the great harvest of evil which England is now reaping from seed sown three hundred years ago, especially as regards the treatment of her pauper and criminal classes. I have said that there is no provision for thorough instruction. The reason is twofold. The first is the reluctance of educators to take up new subjects of study, or, at least, to present them thoroughly. But the other and far more effective reason is the fact that we have so few institutions for advanced education which have the means to make provision for such teaching. The last report of the Commissioners of Education at Washington shows that we have in this country about four hundred establishments calling themselves Colleges or Universities. You may count on your fingers all those which really have any claim to either title. In obedience to the demands of sect or of locality, we have gone on multiplying institutions inefficiently endowed, wretchedly wanting in everything necessary to scientific investigation, until we have now hardly three or four in possession of the means to present any new subject of study involving any outlay for investigation or demonstration. The time has come when such provision should be made. Whether it is to be made by the munificence of private individuals, or by State endowments, is not here the question.

The proposition to which I shall speak especially is this — that provision should be made for instruction in Human Physiology, Hygiene, and Sanitary Science, in all departments of public instruction ; — in our Public Schools, by providing fundamental instruction, especially in the simple principles of Physiology and Hygiene ; in Colleges and Universities, by presenting this general instruction in a more extended way, and by promoting investigation ; in Medical Colleges, by giving more special instruction in matters relating to Public and International Hygiene ; and that in our Departments of Engi-

neering, and Polytechnic and Technological Schools, especial provision should be made for instruction in Sanitary Engineering.

In regard to the first of these provisions, that for popular instruction, few probably are aware of the need of them. Take, for example, the revelation made within the past year at the outbreak of yellow fever in a Southern city. Two things in relation to that revealed very clearly the evil of which I speak. First, the cause assigned for the disease shows the utter want of sanitary knowledge in the people at large, and secondly, the real cause, since revealed, shows the absolute blindness to the simplest principles of sanitary science on the part of those immediately concerned. When the yellow fever broke out at Shreveport, it was telegraphed all over the country that it was caused by the removal of the obstructions in the river above the city. That statement went all over the country unchallenged. So far as I know, no one thought of expressing doubt publicly as to the statement that the yellow fever was caused by a more plentiful supply of water at the wharves of that city — the fact being that this would conduce rather to the removal of the causes of the disease than to the prevention of them. At last came information as to the real cause, and it was found that in that hot climate, men had been allowed to heap up the material in which disease germs arise abundantly, that the simplest truths of sanitary science had been ignored, and that the consequence was perfectly simple and natural.

But it is not merely in such outstanding parts of the nation that such ignorance exists. It is spread throughout our own country districts, even the most enlightened districts, and you will find prevailing in many of our country towns traditions and superstitions in regard to this matter that are most surprising. You will find some of these things which are known to be absolutely deadly, considered on the whole as healthful. Strange as it may seem, you may hear people who take the papers, who are supposed to be within reach of the great sources of information — you may hear such people, I say, maintaining that, after all, the emanations of the cess-pool are rather conducive to health than to disease ; that their fathers lived and thrived in such an atmosphere, and that, therefore, it has a healthy influence. I can point you to an exceedingly pleasant village which I have sometimes to visit, where, with a plentiful supply of water, there is an absolute want of any system of sewerage. Typhoid and typhus go zigzag through that town every year or two, making victims, yet you can't induce the people of that village to believe that their unsewered condition has anything to do with it.

But it is not merely in the country districts that this state of things has existed. Up to a very recent period, at least, this same ignorance was manifested in a very surprising degree in this metropolis. It is now about five years since, with two other members of our State Senate, I visited this city, and sat here in the Commission for examining into certain branches of the City Administration, and especially into the conduct of that branch which had charge of the Public Health. The state of things revealed was such as could only exist under a great and wide-spread ignorance on the part of citizens of the first principles of Sanitary Science. To give an idea of this ignorance, let me recall, as nearly as I can, a little episode in the investigation. It happened

that the late Judge Whiting, who had charge of the investigation on the part of the Citizen's Association, put on the stand a young physician, who testified that the Health Officers, or Wardens, or Inspectors, were men utterly ignorant of the first principles relating to the public health which they were appointed to preserve. In order to refute this, the head of the Health Department at the time brought on the stand, in perfect good faith, several of these Health Officers. Toward the close of the examination of the first of these gentlemen, Judge Whiting asked this question, "Did you have a case of small-pox in your ward?" and he answered, "Yes, sir." Judge Whiting, "Did you visit the patient?" Witness, "No, sir." Judge Whiting, "Why not?" Witness, "For the same reason that you would not — that I was afraid of taking it myself." Judge Whiting, "Did the family have any care?" Witness, "Yes, sir; they were 'highjinnicks;' (hygienics) — they doctored themselves." As the other witnesses came in, Judge Whiting used this as a sort of test question — as a sort of key to unlock the system, and show the utter ignorance that prevailed in every department of it. Every witness was asked: "Well, have you any 'highjinnicks' in your ward?" Some of the witnesses thought they had, some thought they had not, some thought they "had them pretty badly," some thought they "had them in some parts of the ward," some thought they "had them in other parts of the ward." At last the Judge asked a witness who had been answering his question in this way: "Do you know what the word 'highjinnicks' means?" and he replied, "Yes, sir; I do. It means a bad smell arising from dirty water." Of course the exhibition was vastly amusing; but after all the guffaw was over a sad afterthought necessarily came to every thinking man as to the condition of the great metropolis which allowed all its dearest material interests to be placed in such hands as these. It may be said that this was the result of a political system; but it was not. Had there been a tithe of the instruction which should have prevailed, of that simple knowledge that should have existed on this subject, such a thing would have been impossible, no matter what the political exigencies or arrangements were.

So much for the need of popular enlightenment on this subject. Look now at a higher range. It is only a few years since the country was startled by the outbreak of a malignant type of fever in one of the leading boarding-schools in New England. The result was that several ladies from the most respectable families in the country lost their lives. The school had always been considered an admirable one. It was under the charge of a principal and instructors in every way worthy of their calling; but an investigation by competent persons showed that causes of zymotic disease lurked at every corner of the edifice, and that the only wonder was that the disease had not come earlier and spread even wider.

Look now at the want of special and technical instruction. It is little over ten years since the International Commission on Quarantine Matters sat in Paris. They did a great and noble work, but their labors have taken no such hold upon the policy of various States as they ought to have taken. What is the reason of this? There are admirable sanitarians in our own country and in others. We have several of whom the country may justly

be proud; but the difficulty is, that our institutions have not given us enough of them to create and spread a healthy public opinion on this subject. One or two, or half a dozen, cannot, in so great a country as this, accomplish so great a work, and especially they cannot if they are burdened with the laborious duty of a metropolitan physician. There is a great want of special instruction in our Medical Colleges in Public Hygiene — hygiene in its relation to quarantine matters, in regard to the prevention of epidemics, in regard to sanitary provision for the wants of great cities and districts.

Again, if you go into any of our interior States you will find that anything like a thorough or carefully thought-out or wrought-out system of sewerage is a very rare exception to a very widespread rule. Nothing can be more inadequate than the system of sewerage of nine tenths of our cities; and, indeed, until recently, the city of New York, with all its magnificent provision of water supply, and in spite of its splendid position for drainage, was very improperly provided for in this respect.

So much for the want of these different branches of instruction in this great science; and now as to the remedy which I would propose.

First, as regards Public Schools, I would make provision for simple instruction in the elements of Physiology and Hygiene, either by the use of some short and plain text-book, or, what is still better, by lectures from some competent resident physician. I confess that I greatly prefer the latter method. Not only theory, but experience, leads me to prefer it. Were it not that we have made a very great mistake in our systems of public instruction, by severing our common school instruction from advanced instruction, we should by this time have a body of teachers in our common schools abundantly able to lecture to the pupils without a text-book. I trust the time will come when provision will be made by our States just as thoroughly for advanced instruction as for primary and common school instruction — when all will be connected together, — when the present illogical separation that exists, under which primary and common school education is provided for by the State, and advanced education is left very inadequately provided by various religious denominations, will be done away with. But at present we have comparatively few teachers in our public schools who are competent, without text-books, to teach a subject of this kind; therefore it is that I would have provision made, in our larger schools especially, for lectures by resident physicians. That the interest of pupils can be roused in this way I know, for I have seen it fully tried. It is one of those subjects in which, with a little care, the great body of school children can be greatly interested, and this without the slightest detriment to other subjects. The very change of method will make them come back to other subjects of study with renewed vigor.

Next, as to instruction in our Colleges and Universities, I would have instruction in physiology and hygiene more advanced, systematic, and thorough.

Those who have read Herbert Spencer's work on Education, no matter what they may think of some minor ideas, must have been greatly struck by

that part in which he gives his estimate of the comparative value of different branches of knowledge. Among those which should be placed first he names Human Physiology. The reason is very simple. Human Physiology is simply the study of a machine which we are to run, nay, which is to run us for three score years and ten. Certainly it is a study which falls very directly to us. The study of Hygiene naturally comes in connection with it, and it was in obedience to this idea that in framing the general course of instruction for the Cornell University careful provision for Physiology and Hygiene was made. An expensive series of models was purchased, diagrams from Paris and London were obtained, and what was far better, a young Professor, who had already begun to obtain a reputation not only as a close investigator but as an impressive lecturer, was set at the work. The result has been most satisfactory. I am persuaded that study of this kind forms an admirable relief from other studies, pursued in a different way, and for a different purpose. In this case, the study of Physiology and Hygiene has been made very thorough. Frequent and close examinations have been demanded, and it has been made not merely a study for information, but a study for discipline. And here let me say that, as a starting-point for scientific studies, the study of Hygiene and of Sanitary Science seems to me to have great value. It is not, perhaps, the best point theoretically from which to start, but practically it has been found to be as good as any other.

Next, as to instruction in our Medical Colleges, I speak here with great diffidence, for there are those about me more competent to discourse on this question than I am. I am well aware that all the effective knowledge that is given to Sanitary Science in the country, so far as its advanced branches are concerned, is now given in the medical colleges. But it seems to me that not yet is sufficient place given to good instruction in Public Hygiene, sufficient study of that kind which gives to town authorities, county authorities, State authorities, the National authority, a body of experts who can be relied upon in various public emergencies, or, indeed, for ordinary care of public health.

Next, as to instruction in Departments of Engineering, and in our Scientific, Polytechnic, and Technological institutions. Within the past twenty-five years there has been created a science of Sanitary Engineering. I say within the past twenty-five years, although I know that engineering, even in ancient times, had frequent reference to sanitary considerations. Any one who has read the Mosaic provisions, or walked along the Tiber at Rome as far as the mouth of the Cloaca Maxima, is well aware of that; but it is within the past twenty-five years that the science has been placed on solid foundations. Vital statistics have shown the effects of the introduction of sunlight, of pure water and air into our dwellings and cities, and engineering has shown us the best methods of introducing them. Any one who will take up the recent work on this subject by Mr. Baldwin Latham will see what a great conquest has here been made. The statistics show that of seven leading towns and districts in England, such as Croydon, Ely, Salisbury, and others, where careful and thorough modes of sewerage prevail,

the percentage of deaths has been reduced from forty to twenty per cent. I also see, from calculations made on the basis of Dr. Allen's tables, that there is a vast saving to these districts pecuniarily. Taking into view the fact, that for every death prevented about twenty cases of disease are prevented, I will say that judged even from a cold financial point of view the result has been magnificent. What the result would be by good modes of sanitary engineering may be judged from the statement in Dr. Lionel Beale's book on "Disease Germs," which is that by a good system of sewerage one hundred thousand lives might be saved annually in England.

But I am aware of the opposition that will be made to any attempt to introduce these studies. First, it will be said that there is little material in this subject for advanced instruction, and that we know very little regarding the causes or the nature of diseases. That is partly true and partly not true. Unquestionably, the true theory of disease is yet to be wrought out, although everything leads us to suppose that science is at last upon the right track; but unquestionably in relation to the germs of disease, great conquests are yet to be made, and it is a matter of great satisfaction to me, and I doubt not to all of you, that one of the most careful of American investigators is to speak on that subject this evening.[1] So, too, the relations of ozone to various diseases is a matter in which conquests are still to be made. There are multitudes of questions yet to be solved, but still many have been solved already. And a very great conquest was made when it was found that zymotic diseases had relation to physical causes and that the causes were ascertainable and removable. So, too, we have made conquests, as I have stated already, in sanitary engineering. There is material for study. We have made great advances in the study of vital statistics — there is another object of study. I think that this objection, feeble as it is at present, should rapidly become more feeble as science advances, and it should have but little weight among thoughtful men.

But there is another class of objections which are more constantly made, — the same objections that have been made to every change in the curriculum of study, from the days of Erasmus until now. Those objections are on the score of Discipline and Culture. I remember once that when these objections were made in the presence of the late Horace Greeley, he cried out, "Discipline! I hate the word." Nor was this exclamation unnatural. Few words have done more harm to the progress of education than this. I am the last to say anything against what is now known as the older system of education, or of classical education in general. I prize it; I love it; but if there were no other argument to show that it is by no means the only mode of discipline or study, the return made by the Commissioners of the English Government, after their full examination of the English Public Schools, is certainly proof on this point. It is there shown that seventy per cent. of the students under the old system, carried out as it is to its very highest point, failed to make any worthy use of their advantage.

[1] President Barnard of Columbia College presented a paper on "The Germ Theory of Disease in its Relations to Hygiene."

What are disciplinary studies? I maintain simply that they are those which for any reason whatever a man takes hold of, and which take hold of him. It matters not whether the study be in obedience to natural tastes, or whether it be forced upon the student. This is the thing — that the study be taken hold of, and that it take hold of the mind of the person studying. Now, in our primary instruction, the studies which I here advocate take hold of great numbers of pupils; take hold of them by virtue of their being a relief from other studies — by virtue of their appealing to natural objects. Any teacher will bear me out in saying that as regards pupils of an early age, there is no difficulty in this respect. As regards Colleges and Universities, there are but two things on which we can rely to cause studies to take hold upon the minds of students and to receive thorough attention. The first is a love for them on the part of the student. The other is their value to the student as regards his direct aims and purposes in life. We cannot in Colleges and Universities do what was formerly done in England — take the student and whip him. We have to trust to one or the other of these two classes of incentives. Now the number is considerable of those who, from one motive or the other, would take up this great subject of study. All would not do it; the majority, probably, would not do it; but if an opportunity were offered, I am satisfied that from every College and every University would go out a body of men not only well instructed in the great principles which underlie sanitary matters, but well disciplined in the obtaining of such instruction.

And now, as to the other branch of the objection — the objection on the score of Culture. I prize all literary study as highly as any person ought, but yet I maintain that there is, after all, a higher culture. The very ideal, the very god of literary culture is Goethe; and yet, splendid as he was, there is a higher culture which he lacked, even from a purely earthly point of view. I maintain that in the studies I now urge, there comes a culture of high purpose, a culture of thought for our fellow-men, a culture involving the idea of duty, which certainly is worth any other sort of culture.

And if any one objects that these studies are based upon Physiology, which has led man into dangerous paths; that it is, in fact, an unsafe study, I would simply point to these words, uttered so long ago, and from which certainly these objectors will make no appeal: "The fear of the Lord is the beginning of wisdom." There is great truth in these words. We all feel them. But what is that truth, what is that fear? Is it the mere selfish fear which the African native feels for the caprice of his Fetish? Is it the mere groveling fear which the Turkish slave feels for the tyranny of the satrap placed over him? Certainly not. The only wholesome fear is not that fear based on mystic dread of tyranny, but fear to violate those great laws by which the Divine Power which maintains and regulates this universe, governs all. That is the fear which lies at the beginning of wisdom, and among those studies, calculated to impress upon us the existence of laws, the violation of which is followed by penalties strictly imposed, stand foremost those to which this Association is now so worthily devoting its attention — studies which help to make this earth more beautiful and mankind more reverent and noble.

A REPORT UPON "SANITARY RELATIONS TO HEALTH PRINCIPLES OF ARCHITECTURE."

By CARL PFEIFFER, F. A. I. A.,
Of New York.

Dr. Mapother has justly remarked that, after medicine, "as professions most concerned in the preservation of public health rank those of the Architect and Engineer." This paper is designed to illustrate the relations of Architecture to the science of Hygiene; a very important relation, since the architect is required to furnish the dwelling in which we pass much of our lives, while the dwelling exercises a more decided influence upon our health than the clothes we wear. Every adult inhales some 360 cubic feet of air in the course of twenty-four hours, and this is but a tithe of the amount which he requires to regulate bodily temperature; but to insure to each individual the full needed amount, accessible to him every hour of the day, his dwelling must be properly constructed.

EQUABLE TEMPERATURE OF VITAL IMPORTANCE.

The feeding and regulation of temperature of the human body is a matter often overlooked, and yet of equal importance. For, so fixed and immutable is this temperature in a healthy body, that the blood of a negro in equatorial Africa, or of a Hindoo in the heats of Asia, is, by no perceptible fraction of a degree warmer than the blood of a healthy Esquimaux near the north pole. The atmosphere in which these different bodies live may differ as they do, by more than a hundred degrees; but if the clothing and the house do not neutralize this enormous difference, if the temperature of the body is allowed to sink or rise to any perceptible degree, sickness and ultimately death are the result. It is a wonderful hygienic instinct which leads the seal-hunter to build snow-huts, and the European in East India to erect houses with the thickest of walls. Hence, the architect must keep both objects in view if he would not build hospitals and tombs for his clients instead of comfortable and healthy dwellings.

Vast as are the technical requirements which his profession imposes upon him, apart from all sanitary considerations, the science of hygiene further demands from him, that he should study *first*, the climatological and meteorological phenomena of the place where he is to build; *second*, the geological condition of the ground upon which the building is to be erected; *third*, the material of which he is to construct the building; and on the basis of these studies, he must arrange the proposed house in such a manner that it may both feed the human body with air and preserve its normal temperature.

How these studies have been neglected, the majority of our public halls, court-rooms, prisons, hospitals, asylums, churches, school-rooms, etc., are melancholy evidences, not to mention private dwellings, tenement houses, and hotels.

And here let me ask you, who have this matter more especially in charge, should not the law which protects men from adulterated food, and adulterated liquor, exercise its power also to protect him from adulterated air? It is quite true that people get to be fond of adulterated whiskey, coffee, bread, and the like; so fond, indeed, that they seem to prefer them to the pure articles. Thus, if you go into large workshops you will generally find the men bent on keeping fresh air out on coldish days, thinking that if they fill a work-room with the evaporations of their united bodies they will soon make it comfortable. Yet no reasoning is more fallacious than this. It is the fresh air, the cold air from the outside, which has the elements of heat in it, when warmed by a fire, whilst the evaporated air of their own bodies is pregnant with chills, however much warmed.

You will always find, therefore, in closed workshops of *such* a kind, that the workmen clamor for more fire. Why? Because what they conceive to be warming (the evaporation of the bodies of their fellow-workmen), is nothing but deathly iciness. To rid men of the false notion that an adulterated atmosphere which seems warm, is *not* warming, constitutes one of the most difficult problems which you, as well as we architects, have to contend with, since almost all classes of men labor under its delusion.

THE SCIENCE OF VENTILATION.

The special science which has for its object this mediating between the body in this the house, and the atmosphere outside of the house, is called the Science of Ventilation; Ventilation from *ventus*, *wind*, a moving of air. Hence, the problem of that science is to effect such a moving of the air as may be needed to feed and regulate the temperature of the human body within the house, by means of the house. There are two ways by which the air can be thus set and kept moving. 1st, mechanically, by means of fans, called the system of propulsion; 2d, by means of heated chimneys and flues, called the system of suction. In addition to these methods, much is done by what is called natural ventilation; but this is not to be depended upon at all stages of the weather, nor at all seasons of the year, its operation depending upon three forces, viz.: diffusion, winds, and the difference in weight of masses of air of unequal temperature. I may here add that cleanliness in a building is an indispensable requisite in the proper working of any system of ventilation.

Of the mechanical means of ventilation I shall not attempt to speak here for want of time, beyond saying that in all large buildings, nay, in all large cities, they are indispensable, however costly their arrangement.

Concerning the *second*—it is first to be observed that to some degree every house is of itself necessarily a ventilator; and thankful we ought to be that it is so. Streams of air pour continually from the outside through the walls into the inside, not to say through the ground on which the house

stands. These streams may not be sensibly perceptible, as is the water that oozes through the walls and the ground; nevertheless, they are constantly present and operative. Aye, and so powerful are these currents that you can blow out a candle held against the wall close on the inside of a house from the outside. Every wall (particularly the mortar) is porous, and walls are more porous in proportion as they are less moist, for moisture clogs up the bricks, stone, and mortar, and thus obstructs ventilation. Moist walls, therefore, being almost air-tight are unhealthy in a double way: *firstly*, by the action of their moisture, which draws the heat from our bodies, making us shiver, and causing all sorts of rheumatic complaints; *secondly*, by obstructing the passage of the air. Hence, also, the great unhealthiness of new buildings, to which I desire to call your special attention. Doctor Von Pettenkoffer estimates that a newly built house of fifteen rooms and cellar, contains in its materials some 3,300 cubic feet of water, which must be evaporated before the house is properly inhabitable. Please realize this, and say whether or not the law which considers it a duty to provide punishment for the adulteration of food, drinks, etc., ought not by some means to prevent people from occupying newly built houses, wherein it is impossible to breathe aught but adulterated air!

RELATION OF ARCHITECTURE TO HYGIENE.

One of the first principles of architecture in its relation to hygiene is that all the materials of a building should be dry and porous before it is inhabited, and should be subsequently so kept. The very furniture of a house can chill and produce rheumatic affections if it is damp and has been long in an unheated room, for in that case it acts as a power of suction upon our body, drawing out its vital heat. It strikes me as one of the barbarisms of vulgar belief that cold bedrooms are considered magazines of health; they are rather breeders of disease, unless they also have ventilation. People go to sleep in air-tight, cold rooms, in the belief that it is healthy, particularly if they have the bedroom well aired in the morning. Yet all the night long the air in the room stays unmoved and gets slowly poisoned, while the evaporation of the body settles upon the walls and makes them more and more air-tight. If any one fresh from the outer pure air enters such a room, he is almost nauseated by the vitiated atmosphere; even as that open recluse of Walden Pond, Henry Thoreau, used to hold his nose when passing dwelling-houses, the doors of which were opened for the first time in the morning. Cold rooms in winter time, let me add, are not only uncomfortable for the poor but active agents of producing disease; and the phenomenon of epidemics in cold weather — which has excited so much wonder — is a very natural consequence of neglected ventilation; and it is as one of the chief means of checking these winter diseases and epidemics, that Doctor Von Pettenkofer urges governments, above all things, to supply the poor with fuel in winter. For to have ventilation there must be difference between the air in the house and the outside air; just as to get ventilation by means of chimneys you must have fires in the chimneys. It is only when this difference exists, when there is a cold layer of air pressing the warmer air

upward, that ventilation results. But in his cold room, the poor man has no ventilation and he is thus forced by the cold, not only to freeze, but also to breathe a vicious atmosphere.

An erroneous idea seems to prevail in regard to the healthfulness of our sleeping apartments; it is often asserted that they should be cold in order to be healthy; in alluding to this a medical journal states that "A moderate amount of heat is needed in a bedroom, but *that* moderate amount is needed in winter time. There is no advantage in going to bed in a cold room, nor in sleeping in a cold room, nor in getting up and dressing in a cold room. Persons may survive it, many have lost health by it. To have the chill taken off the air on going to bed and when dressing, is comfortable and healthful. A room under forty-five degrees is a cold room for a sleeping apartment, and sleeping in an in-doors atmosphere lower than that is always hurtful, and always positively pernicious, for the simple reason that such a temperature causes the carbonic acid gas of a sleeping apartment to condense and settle in the lower part of the room, where it is breathed into the lungs with all its pernicious results. Sleeping in a room cooler than above named is especially dangerous to feeble, aged, or invalid persons, as it tends to cause inflammation of the lungs. Persons may sleep out of doors with impunity when the thermometer is many degrees lower, because the out-door air is pure, is full of life, full of oxygen, without any admixture of in-door poison, and hence gives a vigor of circulation which keeps the whole body warmed to its natural point, resisting cold and all diseased conditions."

Cold, free, fresh air outside the house is indeed quite a different thing from cold, putrid air inside the house; a fact which, in examining the causes of diseases, is too often overlooked. Chimneys and flues that have no fire in them, far from ventilating, may rather become the means of hoarding and sweeping down disease into the room.

TWO FACTORS NEEDED TO MOVE AIR.

That two factors are needed for the proper moving of air should never be forgotten. A means of escape of foul air, and an inlet of fresh, pure air; and that the means of making these two factors operate upon each other is heat.

Thus, as Doctor Von Pettenkofer wisely remarks, do the walls speak to us of a life of their own; and Shakespeare was not over extravagant, after all, when he represented the wall as speaking and disclosing its aperture, through which Pyramus and Thisbe (the human body inside the wall, and the air outside), spoke to each other, kissed each other, and committed the like absurdities.

I have dwelt perhaps to too great an extent on the ventilation which a house may be made to furnish of itself, by means of its material, if properly dried after its erection, and kept dry afterwards. This, however, is only a small item, and the chief ventilation of a house must always be procured by artificial means; that is to say, by chimneys in one form or another, and these means must be increased in proportion to the exigencies of the building.

Thus it is estimated that there is required for every person each hour:

In Hospitals, for ordinary patients, from 2,000 to 2,800 cubic feet of fresh air.
In Hospitals, for wounded patients, 4,300 cubic feet of fresh air.
In Hospitals, for epidemic patients, 5,600 cubic feet of fresh air.
In Prisons, 2,100 cubic feet of fresh air.
In Workshops, from 2,000 to 3,500 cubic feet of fresh air.
In Barracks, from 1,000 to 1,650 cubic feet of fresh air.
In Theatres, from 1,400 to 2,400 cubic feet of fresh air.
In Meeting-houses, from 1,000 to 2,000 cubic feet of fresh air.
In Schools for children, from 400 to 500 cubic feet of fresh air.
In Schools for adults, from 800 to 1,000 cubic feet of fresh air.

Large as these figures appear, they have been determined in two ways — by mathematical calculation, and by innumerable experiments all of which have corroborated the independent mathematical calculation. Ranke, in his "Grundzuge der Physiologie" (Elements of Physiology), fixes the average quantity at sixty cubic metres, or 2,118 cubic feet per hour for each individual, as the necessary minimum amount. In cities it has to be considered, moreover, that each gas-burner needs the introduction of from four to five thousand cubic feet of fresh air every hour, facts, all of which it is necessary that the architect should keep in mind in order to secure a sufficiency of artificial means of ventilation whereby to furnish this amount of air, and furnish it in a proper degree of purity and warmth to make it conformable to the requirements of the human body. Of course architecture is mainly an art, I am quite well aware, and I am, perhaps, more sensitive than many of my profession upon this point. I desire that our houses, as well as all our buildings, should express *externally* and *internally* beauty, — that harmony, symmetry, proper proportion of sizes, colorings, and the like, which fill the eye with that supreme satisfaction, whereby men are lifted, as by the utterances of religion, to a higher and nobler life.

ARCHITECTURE MUST NOT BE WHOLLY ÆSTHETIC.

But there is this about architecture, that it must not give absolute and undivided supremacy to its æsthetical side. The sculptor, who models a statue, has only beauty in view; the architect, who builds a house, should primarily consider its adaptability to health and comfort, and then proceed to mould those ideas of health and comfort into the utmost possible picture of beauty. It is sometimes argued that ventilation is expensive, and that its cost precludes the general introduction of complete arrangements. To secure a considerable degree of salubrity in a dwelling at a trifling expense, is comparatively an easy achievement. In all the rooms flues may be constructed to allow the heat and the combustion of the gas to escape, and gas-burners may be placed within the ventilating flues and chimney flues over the mantel-piece, to create a strong current in order to facilitate ventilation. These can be covered (where they would necessarily show in the rooms) by pictures hung on hinges in front of the openings having the gas-burners within. The same mode of heating the ventilating flues can be adopted for ventilating other domestic conveniences. Openings can be made and registers put into the partitions communicating with the halls,

and these can be ventilated by skylights with ventilating cowls; these cowls will facilitate the outward and prevent an inward current. In case it should be desirable to close all the windows and doors of the rooms, perforated iron blocks can be built into the exterior walls, upon a level with the flooring beams, and the space between two beams becomes a conduit for the fresh air, the outlet for it being placed (where possible) under the bed, by having a piece of the base board hung on hinges, with an opening behind it to admit the air. The placing of the ventilating registers in the ceilings instead of in the side walls of rooms, forms a feature of ornament, whereas in the side walls they are usually difficult to arrange without being an eye-sore. For each flue in the ceiling a gas-light put into the same flue, upon and accessible from the floor above, heats the ventilating flue, and furnishes it with a more rapid current, and increased ventilation when desirable. The ventilating flues may also be connected with the heating flues by branch pipes for the purpose of exhausting the heat into the ventilating flues when it becomes necessary to shut off the heat, as it has often proved dangerous to shut the hot air registers and retain the heat within the flues. At the same time this exhausting of the superfluous heat into the ventilating flues greatly facilitates the draft of the ventilating flues. The main stairway of a house can also be made to form a great ventilating shaft, over which is formed a glass dome resting upon a cornice of stucco. The frieze of this cornice may be formed of perforated wood-work, representing a fine study of tropical foliage and birds.[1]

For the supply of fresh air to each room special flues can be provided and connected with a steam heating apparatus by which the air is warmed before it passes into the rooms.

IMPORTANCE OF GOOD DRAINAGE.

The matter of drainage is also to be well considered. All the soil and drain pipes should extend to the level of the roof, and the roof be so graded in various places as to conduct the rain water to the soil and drain-pipes; and, as a further precaution against any smell from the drain, they should be connected by a ventilating pipe with the smoke flue beyond the range, to guard against any odors that might otherwise escape from the drain pipe in case of their breaking. The importance of good drainage cannot be valued too highly in connection with public health. We find that the great plague of London and Westminster, in the 17th century, as shown by the parish registers of the Church of St. Margaret, has been attributed to

[1] This, in a private residence built under the supervision of the architect, gives, at first appearance, the impression of elaborately carved work. It is made of flat wood, sawed out to give the outline of the foliage and birds, and the shading and detail of forms have been done in color. Through the perforations of this ornamental work the foul air passes into the space between the glass dome and the outer skylights, and finds its exit through a ventilating cowl three feet in diameter. The glass dome is illuminated. The gas-lights answer the double purpose of features of ornament as well as great assistants in the ventilation, especially upon the occasion of a large entertainment when the house is filled with people, when by means of the heat of the gas, the impure air is being constantly drawn toward the dome, where it finds its exit. The gas flames cannot be seen below the dome.

the want of sufficient drainage and to the narrowness of the streets and lanes. A more recent and convincing proof is the late sickness of the Prince of Wales, caused by the insufficient drainage of Londesborough Lodge.

It is now fully admitted that warming and ventilating should be defined more particularly than has commonly been the case, previous to the erection of a new building, and incorporated with the structure from its first foundation. Since proper ventilation depends so largely upon a system of heating, I should perhaps say a few words upon several modes in use. The physiological effects resulting from particular modes of warming and ventilating inhabited rooms form a most interesting subject of inquiry, and are not only interesting as matters of scientific research, but they closely concern every individual member of the community. It is a question which affects not merely the personal comfort of individuals, but according to the opinion of the ablest pathologists, it influences the health and affects the duration of life. Our dwellings are mostly heated by hot-air furnaces. The hot-air furnace in its present form was first employed at the end of the last century by a Mr. Strutt of Beper, near Derby, for warming his cotton mills, and was soon after introduced into general use. Its distinctive feature is that its application of fire-heat to metallic surfaces is a direct one without the intervention of either water or steam; and it is this feature which in my view makes it utterly objectionable, except perhaps in cases where the object is merely to produce a drying and warming effect of considerable intensity for specific manufacturing or laundry purposes. In all other cases it is to be utterly condemned. Indeed, there seems to be a general concession that the heat produced by hot-air furnaces is of the most injurious character in its influence upon health. Dizziness, coldness, and languor in the extremities, feebleness of pulse, fainting fits; such are some of the symptoms that have everywhere been noticed to accompany this mode of heating, undermining health in its most susceptible department, the nervous organization. Air heated thus artificially without contact of water, acquires an aridity which causes it rapidly to absorb moisture from the skin and lungs of persons exposed to its influences, and the evaporation, by its refrigerating effect, contracts the blood-vessels at the surface, while other parts not being exposed to this influence become in consequence surcharged with the fluids which are repelled from the extremities.

"There is a risk of dryness in air from highly heated metallic surfaces," says Professor Faraday, "which leads me to prefer it warmed by steam or hot water which gives lower temperature: sixty-five degrees by the latter mode will not cause the air to lose any of its humidity, but by the former mode the air requires vapor of water to correct it." All observers, indeed, are agreed on this injurious characteristic of heating with hot-air furnaces, as causing the absorption of the necessary humidity in the air of rooms, and thus inducing the nervous disorders before mentioned as well as being the cause of many other diseases. For as the dew-point[1] of the air in a room

[1] Dew-point is that thermometric temperature of the atmosphere at which vapor is condensed. By exposing a cold body to the air, a fine dew is deposited on its surface, and by

rises beyond its proper degree, the dryness of the atmosphere draws a quantum of moisture from one body altogether beyond what the body can well spare. The most healthy state of the atmosphere can be obtained only when the dew-point of the air is not less than ten degrees nor more than twenty degrees Fahrenheit lower than the temperature of the room. When these limits are exceeded the air will be either too dry or too damp for healthy respiration. Moreover, this dryness of the air which is the invariable result of hot-air furnaces, deprives the atmosphere to an inordinate extent of positive electricity, whereas the evaporation produced by steam heating excites it, and thus relieves the unpleasant and injurious effect of close rooms. "So greatly does evaporation affect the electric condition of the air," says Mr. Hood, "that the diurnal variation in the quantity of electricity follows nearly the same course as the exhalation of moisture, and evaporation is considered to be the principal course of atmospheric electricity." Then, again, the air is always full of myriads of particles of animal and vegetable matter partly emanating from our bodies, and most of which are easily decomposed by heat, and experiments have demonstrated that the dry heat from metallic surfaces operates particularly most injuriously in effecting this decomposition. Hence the unpleasant smell in buildings thus heated, the atmosphere becoming a mass of putrid noxious matter. "And not only," says Mr. Hood, "will the hot-air furnace, which is particularly liable to these objections, act powerfully in decomposing the floating particles of extraneous matter contained in the air, resolving them into sulphuretted, phosphoretted, and carburetted hydrogen with various compounds of nitrogen and carbon, but it will likewise decompose a portion of the vapor contained in the air, absorbing the oxygen and liberating the hydrogen." To this must be added that the iron of the furnace, when heated to a glow, is rendered penetrable to the various hydrogen and carbonic gases of the burning material, which thus fill the air with additional impurities, and far from being an assisting agent in the ventilation of a building, the hot-air furnace considerably adds to the difficulty of providing the necessary ventilation. This is still more the case when the fire is kept high, for it has been fully established that air heated beyond a temperature of 212–250° is unfit for breathing, and in furnaces it is often heated to a temperature of 300–400°, at which it is, of course, utterly valueless for respiration. Indeed, it is almost an impossibility with furnaces to get air heated within the limit specified. Surely it is difficult enough to provide large public buildings with ventilation sufficient to supply them with pure air, without increasing the difficulty by the introduction of a heating apparatus that of itself tends to fill the air with impurities while it does not assist at all in the ventilation, and this is particularly to be remembered in the construction of public halls, court-houses, churches, etc., for vitiated air invariably produces those stupefying effects of a narcotic dullness, drowsiness, headache, nausea, etc., and all such feelings which are utterly destructive of the state of mind above all needed in such buildings. It is not, however, simply a question

observing the temperature of this cold body, the exact quantity of vapor contained in the air at that time is ascertained.

of comfort, but a most important question of health that is involved in this matter of excluding furnaces from our public and private buildings. Few persons fully realize the vast consequences which result from impure air, and how seriously the duration of human life is affected by want of proper attention to this important subject. Dr. James Johnson says, that ague and fever, two of the most prominent features of the malarious influence, *are as a drop of water in the ocean* compared with the other less obtrusive but more dangerous maladies that silently disorganize the vital structure of the human fabric under the influence of this deleterious and invisible poison. "Indeed, to compress the statement in a few words: Carbonic acid intoxication is the most terrible agent of disease, insanity, and immorality which we have to deal with, all the more terrible and dangerous as it is indulged in by all classes, by all ranks. The inhabitant of the most wretched house on Baxter Street clings to the inhabitation of impure air with the same fervor and love as the owner of the finest dwelling on Fifth Avenue, who carefully shuts out pure air under the pretext of excluding 'draughts,' and wraps himself up in the poisonous atmosphere as if it were of all things his best and dearest friend; and what I desire particularly to insist upon as one of the most effective elements in the spread of this carbonic acid intoxication is the hot-air furnace. It not only impairs ventilation but assists in the adulteration of air. To put a hot-air furnace in your house is like furnishing your milkman with chalk, or your wine merchant with strychnine."

As I said at the beginning, sanitary architecture is a matter of transcendent importance to the human race. Vitiated atmosphere is quite as injurious and stupefying as the worst alcoholic drinks. It spoils every dinner, it kills sleep. It is the greatest enemy of the preacher, in that it makes people stupidly drowsy, and puts them asleep. It disarranges the whole natural organism. The judge and jury in a court-room filled with pestilential air, as most of our court-rooms are, are as much under the influence of a deathly narcotic as the inhalers of opium smoke.

The poorer classes of our large cities suffer probably most from this demoralizing breathing of polluted atmosphere. It is well to preach temperance, but is it not also well and of preëminent necessity to preach and procure clean, pure air, and healthy sunlight? Is it not worse than folly to refuse the cup from which your friend has drunk, and at the same time breathe into the inmost recesses of your body the air from the lungs of a promiscuous crowd, whether in rooms, halls, churches, or street or railroad cars, or from a pestilential neighborhood? When we contemplate the almost universal fear of draught, that is to say, fresh air, which pervades almost all classes of modern society, and from the effects of which our little children are made to suffer even more yet than the adult generation, it seems that nothing could be more timely than a crusade against this carbonic acid intoxication, to which men seem so hopelessly given. For this breathing of foul air is nothing but an intoxication, accompanied by all its evil effects, want of appetite, headache, sleeplessness, etc., and the cause of most of those sicknesses which are foolishly ascribed to pure air under the name of draughts. In conclusion allow me to say one word in regard to

drainage, whereby I mean to include any kind of communication passing between the house and the ground upon which it is built. This ground is also porous (the more so, likewise, in proportion to its dryness), and is therefore also somewhat of a ventilator. At the same time, in the close streets of our large cities, where gas-pipes, sewers, etc., run through it to a vast extent, it is also filled with innumerable agents of danger to health, all of which require the most careful watching on the part of the architect, and against many of which science has not as yet provided. Particularly in winter when the house, if heated, draws, as it were, the atmosphere and gases of the adjoining ground into its rooms, are these elements dangerous and conspire to spread epidemics.

I suppose you are all familiar with the case mentioned by Dr. Reid: where about fifty members of one of the Royal Society Clubs at Edinburgh dined in an apartment which he had constructed, so that the product of the gas combustion and the vitiated air were removed by a ventilating pipe, and large quantities of a mild scented fresh atmosphere constantly passed into the room. The gentlemen present at the banquet were unaware of this arrangement, which had such an effect upon them that the caterer was struck with the enormous and increased amount of food and wines dispatched with utmost ease and nonchalance by the same men whom he had so often seen languishing over a dinner in the same, but foul-aired room. Not one of them knew he had displayed an unusual appetite; and no one complained of headache or other indisposition at that dinner or afterward.

Thus, in the most manifold ways is public health connected with architecture; and thus does the Science of Hygiene depend upon the coöperation of the builder. If, by the statement of a few general principles and in a necessarily brief and fragmentary manner, I have succeeded in illustrating the coöperation and mutual dependence of this most noble art and this most beneficent science, I shall feel amply repaid for my endeavors.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8 in.
10 in.
12 in.
6 in.
0 in.
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5 in.
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9 in.
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REPORT UPON "NON-PERIODIC CHANGES OF HEAT AS AN ELEMENT IN SANITARY CLIMATOLOGY."

By LORIN BLODGET,
Of Philadelphia.

The climate of the eastern part of the United States is remarkable for its extremes, both of heat and of cold; and for its constant liability to the intrusion of tropical heats in summer, and arctic cold in winter. And the greater anomaly in regard to these extreme conditions is, that they are, at the time, in no way connected with these outer districts, and are not propagated from or continuous with districts of like extreme severity on either side. When excessive heats prevail the natural inference would be that the tropical districts would at the time transfer their heated and saturated atmosphere to these latitudes, and that the surface atmosphere toward the Gulf coast would be continuously and connectedly similar. But the facts are quite the contrary: these heats do not come from the south, at least along the surface, and the temperature is almost always lower, as far south as our observation extends, than it is in these middle latitudes.

And the same striking anomaly appears in cases of arctic severity of winter cold; at the very time of its prevalence, the weather is usually, and in many cases certainly much warmer at the distant north. The surface atmosphere is never continuously and connectedly cold, nor is there the least appearance of movement of a body of cold air from the arctic regions as the cause of the severity we feel. The depression originates in the districts in which its greatest measure of departure from the mean occurs. As an illustration of the actual conditions characterizing these cold extremes it may here be stated that a departure of 60° of Fahrenheit's thermometer, from the mean of any one of the winter months, is possible in any winter in the northern interior districts. For most of the area of the central interior and Atlantic coast the like possible departure is not less than 45°.

The maximum of heat is of course far less in its range, or departure from the monthly mean, yet it is still very striking in comparison with the range in the adjacent tropics. While on the islands and coasts of the Gulf of Mexico, and also on the South American coasts, the mean is 77° to 80°, and the maximum rarely above 85°, we here may have a monthly mean in summer of 85°, and a maximum of 100°; while at the same time, not only Havana, but Key West, Savannah, and even Charleston may be many degrees cooler. In all cases where comparative observations have been available at such periods, the whole sub-tropical coast of the Gulf in the United States has been much cooler than the great cities of the north, Philadelphia and New York.

The significance of these great facts of our climate becomes very great when we come to deal with their practical consequences in sanitary administration. To us of the great cities the extremes of heat and saturation come with fearful effect on the crowded population and active habits to which all are accustomed. Not, as in the tropical east, and in the torrid climates generally, is there here any adequate preparation or precaution. Intense activity and severe physical labor characterize all classes, and upon them all, without a day's warning, comes down a degree of heat under which ordinary labor and exposure become extremely dangerous to health and life. Even for the heat alone, with its usually attendant saturation, mere endurance is scarcely possible, and hundreds of cases of sudden death or prostration occur where the best care, as the matter is now understood, is taken to mitigate the severity.

Still more general and comprehensive are the changes wrought at these times on the animal and vegetable growths, and in the decay of everything capable of decay. Masses of organic matter accumulated in the cities are driven into rapid decomposition, and the very air is filled with germs of morbid and dangerous organisms. It is wonderful to see the effects of two weeks of such heat and saturation as we had from the 12th to the 23d of August last (1873): the crowd of anomalous growths and the rapid decomposition of every form of organic matter. An ultra-tropical atmosphere in fact envelops us, the duration of which we cannot divine, since it does not come through any atmospheric circulation which we can observe at our borders. It may last a day or two, and it may last two weeks or more. It may prevail only on a narrow line of the Atlantic coast, being wholly unknown at a distance of two hundred miles inland, as was the case in 1870, or it may prevail equally west of the Alleghanies, and over most of the Ohio Valley. Heat may be excessive without excessive saturation, and such is often the case in the interior. But on the Atlantic coast, and southward from New York, saturation almost always attends on great extremes of heat.

It is on these occasions that the greatest demand is made for energy and intelligence in sanitary administration, and that the effectiveness of the institutions for the protection of the public health is most severely tried. In many conspicuous instances, most destructive epidemics have appeared to have their origin in such circumstances, and though when once developed, and malignant in character, they become uncontrollable, as well as go beyond the limits of specially favoring conditions, there is reason to believe that they were all originally within control or prevention, had the intelligence and energy now directed in this great city to the protection of the public health been present in all these cases. The yellow fever at Philadelphia in 1793; at Norfolk in 1854, and the recent scourges at Shreveport and Memphis, were undoubtedly all within the power of a forewarned and competent Board of Health to control.

It is the duty of students of atmospheric physics to shed every possible light upon the law of these climatological extremes; yet at present it must be admitted that the knowledge we have of them is negative rather than

positive. We have recently, through the valuable agency of the telegraphic system of synchronous observation, been able to learn much as to the question of their approach to any point, or their supposed march across the country. The chief fact disclosed is that they do not move with any known system of atmospheric movement, at least in any definable degree. There is, it is true, a general probability that great heat or very low temperature experienced on any one day at a meridian near the Mississippi, will on the next, or a subsequent day, be observed some 300 or 800 miles eastward. But this is more likely to be true of moderate changes than of extreme changes. The special excess is what we have to deal with, and this, it is certain, is far more incomprehensible in its laws of origin and movement, than the ordinary phenomena of changes are.

There is a general law of atmospheric movement in these latitudes that carries with it the ordinary cycle of changes in temperature, in humidity, and in the specific deposit of moisture in rain. This is the movement from west to east, which is undoubtedly an established law of circulation for a belt of surface nearly coincident with the territory of the United States, from the Gulf of Mexico to Labrador. But in winter this belt recedes southward, so much as to afford, especially in the central interior of Minnesota, Dakota, and Wisconsin, large areas of dead winter calm, such as often continues for long periods in the winters of British America, and the Arctic regions. During our winter, we are, at the 40th parallel, nearly on the northern border of this circulation; and it is just at this border that those fearful depressions of temperature are liable to occur which have on several occasions been very destructive to life on the northern plains. In Minnesota last winter, a storm of this class began January 7, lasting two or three days, and destroying hundreds of lives. Again, March 1, one similar, but less severe, exhibited the same characteristics, which were that the sudden fall of temperature was local, and that the change was not propagated from any point westward or northward, but that it *came down*, if it may so be described, as if the rarefied and intensely cold volumes of the upper atmosphere had suddenly descended to displace those of the surface. And by this sudden refrigeration the ordinary moisture of the whole body of air was converted into spiculæ of ice, rather than into snow, and driven with extreme violence along the surface.

Something of this arctic severity may at times of extreme cold be witnessed in New York and New England; but it is more marked in Wisconsin, Iowa, and Minnesota. It establishes, in my opinion, the position with which I opened this paper, namely, that in the sweep of climatological alternations we find the arctic climate imposed upon us on one side, as well as the extreme tropical features on the other.

The excesses of heat are, however, the great exigencies in sanitary administration. These excesses rarely or never occur in the regular line of movement from west to east, which may be identified as being constant in the Lake District, and at the 42d parallel. During the greater heats of summer the whole area of British America, probably to the Arctic seas, is warmed and permeated by westerly winds, and thus vent is given for the body of air to be moved which withdraws it from most of the area of the United States

south of the 35th parallel. Even up to the 38th, or in the latitude of Philadelphia, many days of summer often pass without the slightest evidence, in any part of the atmosphere, of movement from west to east. For the time, there is clearly no such circulation, and it is on these occasions that tropical heat and saturation supervene, and subject our crowded cities to dangers greater than any known in the world elsewhere.

A conspicuous instance of this temporary cessation of the normal circulation, and of the substitution of what may have passed very well for an Isthmus rainy season, occurred from August 12 to 23 of the present summer. From the first named day to the last, the whole area of the eastern slope of the Alleghanies from North Carolina to New York, was more or less completely occupied by a highly heated and densely saturated atmosphere, slowly drifting northward and inland, and condensing immense volumes of water at frequent intervals. At the immediate coast of the Atlantic the cooling influence of the sea kept down the excess of both heat and moisture, and west of the Alleghanies, even at Pittsburg, the heat although considerable, was not so extreme, and not attended with saturation. At Philadelphia, the heat and saturation, with flooding rains almost daily, continued until the night of August 23, at which time the first instance or appearance of atmospheric movement from the west was apparent.

Drifting northward, with a slowly narrowing line, this saturated atmosphere passed on August 23 into the belt of cooler temperatures and westerly winds, and then occurred the fiercest storm known to recent history along the coasts and islands of the Provinces, destroying hundreds of vessels, and reaching to Labrador and Newfoundland before becoming exhausted.

But to the cities of Baltimore, Philadelphia, and New York, this tropical period was one of great danger. Any mere spark of contagion in yellow fever or cholera might have set on foot a fearful epidemic. I can certify for one of these cities at least, that rarely or never has the presence of organic matter in rapid decomposition been so abundant, and but for the floods of rain that providentially fell to wash the streets, no one could have told the dangers. All the teeming forms of microscopic life which heat and moisture could generate, filled the air, and covered, as with slime, every foot of the surface. The bricks of the pavements and house walls became green with slimy growths, and the close, humid air appeared sodden with stagnant elements. This was the perfect breeding ground of pestilence, and had not the marvelous energy and ceaseless vigilance of the New York Board of Health guarded the great port of the country from contact with imported contagion, there might again have been a scene of death like that at Norfolk in 1854, or Philadelphia in 1793.

We ought to know our danger, as well as to provide ourselves adequately for any emergency. It is my purpose, and my part of the duty to show you that our climate is inherently liable to great capacities for sanitary misfortune, as I may say. If we know that it may be ultra-tropical for one or two weeks of any summer, it is a duty to prepare the public for all the contingencies of such a condition, and to erect institutions of safety against possible epidemics.

I do not attempt, here, any solution of the law of these great non-periodic changes of temperature; neither of those which give us the dangerous extremes of low temperature, nor those which bring to us, of the so-called temperate latitudes, ultra-tropical measures of heat. I am satisfied that an extended period of observation, going much beyond the present extent of available observations, is necessary to solve the question whether there is any law of recurrence, or any recognizable cause within our reach. In a recent brief reference to them before the American Philosophical Society (Feb. 21, 1873), I have indicated some probable deductions, which are outlined rather than proved, or demonstrated, and to which I will here refer:—

"In a philosophical point of view the inquiry is broader and more comprehensive. It is a great enlargement of the inquiry in regard to storms, introducing new elements and more important calculations. It appears to be broader in its scope than even the atmospheric circulation which is now so well established, and through which most of the phenomena of the evaporation and precipitation of atmospheric moisture are regularly ordered and instituted. Storms are but incidents of this system of circulation, with its consequences of evaporation in the tropics, and precipitation in the temperate latitudes. We can set bounds to it, and fix its constants with a fair degree of accuracy. The atmospheric movements, whether superficial, or in the superior strata, can easily be reduced to a resultant, and their significance determined almost as positively at the fortieth parallel, as can that of the trade winds on the borders of the tropics. The constants of atmospheric precipitation are also of comparatively easy determination, and the sea of water falling in rain and snow can be measured and its depth determined with a close approximation to accuracy. So also of the averages or fixed constants of heat; there is little difficulty in reducing all the irregularities disclosed in successive months, seasons, or years to determinate values, fixing the isothermal illustration with reasonable precision.

"But the great single non-periodic variations of heat are more difficult to grapple with than any other phenomena of their class. They are not traceable, as storms are, from any point of natural initiation, through a moving path of growth to maximum proportions, followed by regular and natural exhaustion until the equilibrium is restored. An excess of moisture arising in the atmospheric circulation at a colder latitude must be precipitated from the air which can no longer sustain it; and in the course of its natural and inevitable condensation, all the phenomena of storms are developed. But there are changes of the measure of heat which occur in quite as large a degree wholly independently of any such phenomena, as they do in concurrence with them. Indeed, there are at times extraordinary depressions of temperature departing widely from the normal measures for the month or season in which they occur, which appear to *strike down* — not to be transferred along the surface with any atmospheric movement — and to force from the air every vestige of contained moisture; as if some external compressing force had been applied.

"As I have proposed only to open the subject at the present time, I beg to offer a few propositions for consideration rather than to suggest that they are even preliminarily proved. It is a very laborious work to investigate the subject through the rigid processes of induction which can alone establish positive principles. It is easier to indicate some negative determinations; and these are so important, and so much at variance with the analogies of change in the atmospheric problems heretofore investigated, as to induce me to anticipate more conclusive results and present them in this paper. The following are the propositions: —

"1. The greater non-periodic changes in the measure of heat in the temperate climates of the North American Continent are not connected with or dependent upon the system of atmospheric circulation of these latitudes; nor on the incidents of this system, in the evaporation and precipitation of moisture, nor on the greater phenomena of such precipitation in the form of local or general storms.

"2. There is no evidence of movement in these greater changes, either with or against the course of movement belonging to the ponderable elements of the atmosphere.

"3. The periods of extreme cold do not come from, or connect with like conditions at the

North; they are not transferred from the North southward; often the reverse is the case, and unusual mildness prevails in observed portions of British America, at the time that almost arctic severity prevails in much lower latitudes and in various parts of the Northern and Central States.

"4. The periods of extreme heat do not come from, or connect with periods of extreme heat at the South.

"It is often much cooler at Charleston, Key West, and elsewhere at the South than it is at Baltimore or New York in these cases of excessive heat. And a whole month, as well as a shorter period, may exhibit such comparatively cool weather at the points from which it might be inferred that the heat would be transferred to us. In fact, at Charleston and Savannah, the intense heat of the last summer (1872) at New York and the North were unknown — a mean of 85° at the North being reduced there to a mean of $81\frac{1}{2}$° only.

"5. These more striking non-periodic extremes, both of heat and cold, appear to be instituted at the districts where they are felt, by or through some superior and extraneous agency, the elements of which are at present extremely difficult of determination.

"I beg for the present merely to submit these propositions, as being indicated only, not proved, although much time and observation have been given by me to the consideration of the subject. I shall also submit, at an early day, the numerical elements of the investigation so far as conducted."

Enough has, I think, been said to prove the great importance of a thorough examination of the striking phenomena of climate which transforms our summer, the normal, elastic, inspiring summer of the Northern United States generally, into that of the seething jungle of the tropics, alike dangerous to health and life. If it were possible to anticipate these periods, to know from what points they come, and when they are coming, a vast service could be rendered through vigorous warning and specific preparation. But now, not only are the occupations of the people unremitting and business and labors of every sort broken in upon, without due precautions, but the cumulative and criminal neglects of administration, as exhibited in foul streets, undrained thoroughfares, and unnecessary accumulations of pestilential matters, augment the danger, and render temporarily the great city of the Atlantic sea-board less healthy than either Calcutta or Bombay.

For the present, we at least can know the specific fact that at the fortieth to the thirty-eighth parallels of latitude in the United States, the summer climate may be quite other than that which normally belongs to the latitude. The change which brings it is also absolutely non-periodic; it may take place in any year and it may be intermitted for five years. It may continue for one day only, or it may continue for fifteen days. Its germs of malaria or pestilence may be killed again by the elastic atmosphere of cool northwest winds almost immediately after they are created; and also the first breath of cooler air may not be felt until fully two weeks of stagnant heat and humidity have covered the surface and filled the air with morbid and dangerous growths. Such was, in fact, the case at Philadelphia in the summer of 1873, where the evening of August 23 brought the first relief from a period of heat and saturation almost uninterrupted after August 12.

Greatly diversified as the American climate is in different sections, even in the same latitude, it is not possible to assign uniform values to thermometric observations, when their sanitary consequences are considered. Particularly on the plains and prairies of the West and Northwest, the heat of the surface in summer is often great without special injurious conse-

quences. These are local and superficial conditions, often experienced in various parts of the East and North ; extreme, and temporarily severe, as they sometimes are, they are essentially distinct from the greater periods I have intended here to describe. It is true that one form may pass into the other. A high degree of heat may begin with a dry and elastic atmosphere, during the prevalence of which dryness, disastrous sanitary effects may be scarcely known ; but the same occasion may develop into the malignant form, as I may almost say, the presence of moisture in excess transforming, in a short time, an air like that of Arizona, to the deadly characteristics of the Terras Calientas of the Mexican coast. What we have to fear as a fact, and what it is our duty to examine with philosophical precision, is the recurrence of each period of heat and attendant saturation in a latitude to which they are normally foreign.

And we have also to encourage, and indeed, to demand, of every great municipality, the establishment of powerful agencies for guarding the people against the dangers to which they are subjected at such times. These dangers increase with the growth of these cities, and the most fearful consequences have already more than once ensued from want of preparation to meet such emergencies.

RELATIONS OF WATER TO THE PROPAGATION OF FEVER.

By AUSTIN FLINT, M. D.,
Of New York.

Of the late acquisitions in medicine, one of the most interesting and important is the discovery that typhoid fever may be communicated through the medium of water used for drinking or culinary purposes. It is now less than half a century since the researches of Bretonneau and Louis established the basis of the individuality of this disease. Its non-identity with typhus fever has only within the last quarter of a century been generally admitted; and even now there are some who deny this well-settled doctrine. The contagiousness of typhoid fever has been a mooted question since the date of Louis's researches. It is possible that the doctrine of its non-contagiousness has at the present time some adherents, but the proof of its communicability has been rendered so abundant and conclusive that the number of those who are not convinced of the fact must be exceedingly few. Heretofore, however, some of the ablest of observers and authors have advocated its non-contagiousness. A concise statement of fundamental facts relating to the contagiousness of typhoid fever will prepare for an appreciation of our knowledge touching the agency of water as a medium for the communication of this disease. For the sake of conciseness I shall embody these facts in a few propositions.

(1.) Typhoid fever is very rarely, if ever, communicated by means of emanations from the bodies of patients affected with the disease.

My own experience in this regard accords with that of numerous observers cited by Murchison, exclusive of an epidemic many years ago, within a circumscribed area, of which I shall presently give an account. I have known of very few instances in which personal intercourse could be suspected as the means of communicating the disease. In these few instances there was room for the supposition either that the disease was not communicated, or that contagion was received otherwise than through the atmosphere. The disease does not spread from cases in the hospitals to fellow-patients, nurses, and medical attendants. This statement is based on large opportunities for observations for more than twenty years. The different members of a family are seldom affected successively in such a way as to show communication of the disease from one to another. Certainly, as a rule, whenever several persons in a family become affected, the most rational, if not an obvious explanation, is that they have been exposed to a cause alike common to all. As a rule, when persons contract the disease in one locality, and pass through the disease in another locality they who

are brought into contact with, or proximity to, those persons do not contract it. There are exceptions to this rule, but in the exceptional instances there is now a more satisfactory explanation than that which refers the communication by means of an infectious miasm. These are the considerations which establish the first proposition.

(2.) Isolated cases of typhoid fever are numerous, occurring in situations and under circumstances which preclude the possibility of the disease being due to contagion.

It has been said in contravention of this proposition, that contagion may be operative in these cases, although its sources be not discovered, as, for example, we suppose is the fact when small-pox occurs without our being able to trace it to any exposure. This, however, is not a fair comparison. For the cases are few in which small-pox is not known to be produced by contagion, and hence it is rational to infer the latter, although not known, whereas the number of isolated cases in which typhoid fever occurs without any known exposure in any way is so large that when it is otherwise, coincidence or a common causation is to be inferred rather than communicability.

(3.) Outbreaks of typhoid fever have repeatedly occurred in houses and public institutions in consequence of morbific emanations from sewers, cesspools, or drains, and from their contents either exposed upon the surface of the ground or permeating the soil. Facts warrant the belief that under certain circumstances the special cause of this disease may be a product of decomposing changes taking place in collections of human excrement. It is claimed that this product always involves a contagium, but in many instances the circumstances are such as to render this not merely improbable, but apparently impossible.

(4.) Certain outbreaks of typhoid fever are evidently dependent on the importation of cases of the disease, the circumstances being such as to furnish logical proof that the outbreaks are due to the diffusion in some way of a contagion.

In the outbreaks now referred to, not only is the disease not produced by local causes alone, but the special cause is a morbific product derived from the bodies of those affected with the disease — a product the efficiency of which depends on its source being the body of a patient having typhoid fever. In other words, the special cause is not an extrinsic poison which patients bring with them, but it is an intrinsic typhoid product — that is, a contagium. An instance, which is perhaps the most remarkable on record, exemplifying the correctness of this proposition, will be presently stated.

These four propositions are submitted as embodying fundamental facts which can be fully established by logical proof. The scope of this paper will not permit me to adduce the proof which might be brought forward for the establishment of each of the propositions. I must, therefore, take it for granted that the facts embodied in the propositions can be fully substantiated. Assuming this, it follows that typhoid fever may or may not be contagious.

Between it and typhus fever there is this difference, namely, typhoid fever is not, like typhus, communicable by means of impalpable emanations from patients affected with the disease. At least, if it be ever communicated in this way, the instances are rare exceptions to the general rule. As a rule, when typhoid fever occurs in isolated cases, there is no proof of its having been caused by contagion — in this respect, differing from typhus fever. Typhoid fever may be produced by elements derived from healthy persons, which we have no reason to believe is ever a source of typhus fever. But typhoid fever is capable of producing a contagium by means of which the disease is diffused, herein affiliating with typhus fever. Typhoid fever thus may occur sporadically, endemically, and epidemically.

I come now to inquire as to the source of the typhoid fever contagium. If it be not contained in emanations from the body, it does not, of course, proceed from either the skin or the air passages, and there is certainly no palpable product containing it on the surface of the body. We are, therefore, brought, reasoning by way of exclusion, to seek for it in the alvine dejections. If it be contained in these, by what avenue does it gain entrance into the system? If the dejections containing the contagium are conveyed from dwellings by soil-pipes, we can understand that it may pervade the atmosphere of houses, in consequence of defective provisions against the escape of sewer emanations, and if excrementitious matter be deposited on the surface of the ground, the atmosphere within a certain area may be polluted by emanations therefrom, which contain the contagium. But there is logical proof of the diffusion of the disease by contagion under circumstances which render it vastly improbable that the contagium is inhaled; and therefore, reasoning again by way of exclusion, we are to consider the alimentary canal as the avenue through which the contagium enters the system. Thus we are rationally led to the conclusion that drinking water is a medium by which typhoid fever may be communicable.

I have spoken of this conclusion as a late discovery. The supposition or theory that drinking water is a vehicle by which the typhoid contagium may be carried into the system, is not of very recent date. It was enunciated by Canstatt, in Germany, in 1847, and it has been inculcated since an earlier date by Professor Von Giett, of Munich. Riecke, also a German, author of a treatise on special pathology and therapeutics, published in 1852, reported several instances in which outbreaks were traceable to drinking water polluted with sewage. More recently observations have been contributed by British writers, and especially by Dr. Wm. Budd, which seem to furnish demonstrative proof of the communicability of the disease in this way.[1] Budd, however, and others, have contended for the existence of a contagium in the typhoid dejections received into the system either by means of drinking water or atmospherical emanations, as exclusively the cause of the disease. They claim that the dejections contain a virus not less specific than that of small-pox, and that typhoid fever is never produced otherwise than by the introduction of this virus into the system. Facts ren-

[1] My authority for these statements is Murchison. *Vide* work on Fever, second edition, 1873.

der such a doctrine untenable. If the propositions which have been stated are correct, communicability through a contagium in the alvine dejections will account for the connection in only a certain proportion of instances.

For the numerous observations on which the causation of typhoid fever by the agency of a contagium in drinking water, in a certain proportion of instances, rests its claims as a recently discovered truth, I must refer to works treating of this subject. I shall content myself in this paper with an account of an outbreak of the disease which came under my observation thirty years ago, antedating any publication on the subject. I have alluded already, in this paper, to the outbreak now referred to.

It is, perhaps, the most remarkable on record as embracing a combination of circumstances proving, in the first place, the communicability of typhoid fever, and in the second place, rendering vastly probable, if not certain, the communication by means of a contagium contained in drinking water. The circumstances which relate to the latter point are more significant and forcible because at the time of the outbreak, and until within a late period, the agency of drinking water as a vehicle of contagion was not thought of. The facts were recorded and published by me without any idea that water was the medium of the diffusion of the disease. So completely were the circumstances combined with regard to this mode of communication that had they been deliberately planned with the express intention of rendering the proof as convincing as possible, nothing could have been added. Accident fulfilled all the requirements of careful experimentation with a view to test, first, contagiousness, and, second, the correctness of the theory that the contagion may be contained in drinking water, and in this way gain entrance into the system.

The outbreak occurred in 1843, at a place called North Boston, in Erie County, N. Y., situated twelve miles from Lake Erie. The situation at the time mentioned was in every respect salubrious. There were no paludal grounds in the neighborhood. Neither intermittent fever nor any disease had prevailed for several years. Not only was typhoid fever an unknown disease in that particular situation, but in *no part of the county had it been known to have occurred up to that time.* The fever then and previously indigenous in this section was a mild remittent, or, as it was generally called, bilious fever. The place called North Boston was a small hamlet consisting of a cluster of houses, embracing nine families, all situated within an area of one hundred rods diameter, but the few houses in which the disease occurred were closely grouped around a tavern, the house farthest removed from the tavern being only ten rods distant. Forty-three persons made up the entire community. On the 21st of September, a young man from Massachusetts travelling westward in a stage-coach (there were no railroads then in that part of the State), took lodging at the tavern. He had been ill several days, and kept on his journey until he felt unable to proceed farther. He remained at the tavern and died on the 19th of October — twenty-eight days after his arrival. From the testimony of two intelligent physicians who attended this patient, it is certain that his disease was typhoid fever. This fever prevailed to some extent in that town in Massa-

chusetts which the patient left when he started on his journey. Between October 14, five days before the date of his death (October 19), and December 7 (twenty-one days), *twenty-eight of the forty-three persons comprising this little community, were attacked with fever, and in ten instances the disease proved fatal.*

The first person attacked was a son of the inn-keeper, aged sixteen years. A few days afterward, a daughter, aged fifteen years, was attacked, and afterward, in this family, there were five cases, making the whole number seven (exclusive of the stranger). In three of these cases the disease proved fatal. A son of the inn-keeper, who lived at a distance, but at the time of the epidemic came to assist his father's family, and occupied with his wife part of a house about four rods from the tavern, was attacked on the 15th of October. Two cases occurred in a family living about three rods from the town, the patients being children aged seven and nine years. In a family living about three rods from the tavern there were seven cases and two deaths. In a family living about ten rods from the tavern were seven cases and five deaths. In a family living three rods from the tavern were four cases, all recovering. One case occurred in a family living within twenty feet of the tavern. Of these six families, in five the heads of the families, that is, the husbands and wives, were living; the sixth family consisting of a widow and son. The widow was about fifty years of age, and the ages of the male heads of the remaining families were between forty and fifty years. The ages of the wives were not much less. All these escaped, a fact which affords an illustration of the diminished liability to typhoid fever after about forty years of age. Of the families which composed this community, three escaped the disease. Of these three families, one lived about forty rods from the tavern, a stream four rods in width intervening. Another family lived at about the same distance. The third family lived only four rods from the tavern. The latter was the only family which escaped of the seven families grouped immediately around the tavern. This family consisted of a man named Stearns, his wife, four children and a boarder.

The escape of two of these three families may be explained by their distance from the tavern; but how is the exemption of the third family, living only four rods from the tavern, to be accounted for? In connection with this inquiry an important fact may be mentioned. The family of Stearns had quarreled with the family of the inn-keeper, and were on terms of non-intercourse. After the breaking out of the epidemic the members of this family had no intercourse with any of the families in which cases of fever occurred. I ascertained from Stearns that no member of his family saw any case of the disease. A reason for this will presently appear.

The facts of this epidemic, as thus far related, prove the importation of the disease, and its diffusion by contagion; but in reference to these points, let me recapitulate the facts: "In a small, isolated community, consisting of nine families, seven of which lived within a few rods of each other, a patient affected with typhoid fever is introduced, and after lingering twenty-nine days dies with this disease. But up to that event the members of this

community were free from disease of any kind; the situation was in every respect healthy, and typhoid fever was unknown in that place and neighborhood. The patient lingered and died at the tavern, which was a place of daily resort for the members of those seven families, with a single exception. One family, consisting of several persons, living but four rods from the tavern, was on terms of hostility with the inn-keeper, which precluded all intercourse. The arrival of a sick stranger with a severe disease was an event of interest to the inhabitants. He was visited more or less, daily, by the different members of the families living close at hand with the exception of one family, and the members of the inn-keeper's family were, of course, brought into close contact with the disease. Twenty-three days after the arrival of the stranger, two members of the family of the inn-keeper were attacked with the disease, and subsequently five others in this family. In all the other families living within a few rods of the tavern, excepting a single family, cases occurred within about a month, and during this period more than half the population of this little community had been affected. The disease then ceased further progress, no cases afterward occurring. The family in which no case occurred was the only family of the seven families grouped immediately around the town which escaped. The relations of this family to that of the inn-keeper precluded all social intercourse, and, shortly after the disease began to spread, its production (as will presently be seen), being imputed to the agency of this family, intercourse of the latter with all the families affected with the disease was at once suspended." This recapitulation is quoted from my report of the epidemic published in 1852, in a work entitled "Clinical Reports on Continued Fever." This work has for years been out of print. To the extracts just quoted were added the following remarks: "Now in view of this reviewal of the facts, if it be claimed that the disease was not transported to the place, and diffused by contagion, it is necessary to admit a series of coincidences almost incredible. The circumstances embrace all the important conditions for a fair experiment in order to test the contagiousness of a disease. Indeed, if every circumstance connected with the outbreak of the disease at North Boston had been deliberately selected and arranged for a scientific object, they could hardly have been rendered more complete."

An important part of the history of this epidemic remains to be stated. At the time of writing the report from which the foregoing extracts are taken, and for many years afterward, indeed, up to a recent date, I had no idea of the diffusion of typhoid fever through the agency of drinking water. At the time of the epidemic nothing had been published on the topic, and at the time of writing this report and long afterward, I was not aware that any one had entertained this view of the causation; there was nothing relating to it in the medical literature of this country. At that time the non-contagiousness of typhoid fever was enunciated in standard works among the points showing the non-identity of this fever with typhus. I supposed that the disease at North Boston was communicated by means of a contagium contained in the emanations from the body. I shall now cite from my report certain facts which render vastly probable if not certain, the belief that the disease in this

epidemic was communicated through the agency of drinking water. I quote further from my report as follows: "The occurrence of a severe form of disease, affecting in a brief period more than one-half of the small, isolated community, and proving fatal in so large a proportion of cases, as might be expected, occasioned not a little excitement at the place. This was naturally occasioned by the fact that the disease was one presenting, for that locality, remarkable features, giving rise to discussion and discrepancy of opinion among the medical practitioners of the neighborhood. The popular explanation of the origin of the disease added greatly to the interest of the excitement. The story was started that the disease was caused by some poison introduced into the families affected through the agency of Stearns, whose relations to the inn-keeper were hostile, and whose family alone, of those living close to the tavern, was not affected. The family of the inn-keeper and the other families in the immediate vicinity were in the habit of obtaining the water used for drinking and other domestic purposes from a well near the tavern. It was charged upon Stearns that he had poisoned this well, and that this was the source of the disease. This story was believed by nearly all the inhabitants, so that several pumps were placed in the well, and an effort was made, but without avail, to exhaust all the water which it contained. The family of Stearns alone, of all the families in the immediate vicinity, did not draw water from the tavern well. This family, up to a short time before the outbreak, had obtained water from this well; but owing to the animosity of the inn-keeper, this privilege had been denied to Stearns, so that he was obliged to dig out and deepen an old well of his own. Two other families which escaped, did not get water from the inn-keeper's well owing to their distance from the tavern. By all the other families the water from this well was used daily. These facts, coupled with the relations between Stearns and the inn-keeper, and the singular character of the disease, were considered to furnish circumstantial proof of guilt sufficiently conclusive. The charge of poisoning was so openly made that a prosecution for slander was commenced by Stearns, which was finally settled on the payment, by the party prosecuted, of a hundred dollars. Some water which I obtained from the well was examined by chemical re-agents and found to be remarkably pure as regards saline constituents. It was not, however, examined for organic matters.

Now, taking into view the statement contained in one of our preliminary propositions, namely, that typhoid fever is rarely, if ever, communicated by means of emanations of the body, together with the observations which within late years point to drinking water as the medium of communicability, that the latter was the mode of diffusion in the North Boston epidemic hardly admits of a doubt; and the circumstances were as remarkably combined with reference to this conclusion as with reference to the proof of contagion. It can hardly be doubted that the exemption from the disease of the family of Stearns was due to the animosity of the inn-keeper, which led the latter to *prohibit the use of his well, and compelled Stearns to dig a well of his own.* The two families living forty rods from the tavern escaped because, owing to the distance, they did not obtain water from the inn-keeper's well.

It may be asked, Is it certain that the special cause was a contagium; was not the disease produced simply by excremental decomposition, since facts show that it may be so produced? In other words, may not the disease have been produced by changes occurring in connection with the dejections, without the presence of a contagium? The answer to these questions is this: If due to excremental decomposition without a contagium, why did the disease break out so rapidly shortly after the arrival of the sick stranger? It is far more rational to infer the existence of a contagium than to consider the connection of the epidemic with the arrival of the stranger as a mere coincidence. At the time of the epidemic no suspicion of the presence of the special cause in the drinking water being entertained, pains were not taken to note the situations of the privies, the nature of the soil, etc. In order to obtain some information on these points, I wrote recently to Dr. P. Barber, at the date of the epidemic, and until lately a practitioner in that neighborhood. Dr. Barber writes that, according to his recollection, the privy attached to the inn was situated three or four rods from the well, and he recollects that the contents were allowed to accumulate. The well was by the road-side, supplying with water the inn and the stables, as well as the immediate neighbors.

Another question may arise, namely: Was the evidence conclusive that the disease was typhoid fever? During the progress of the epidemic, when the excitement was at its height, I visited the place on behalf of the county authorities, in order to investigate the nature and origin of the disease. I made an autopsy, noted the history and symptoms in all the cases then in progress, and afterward obtained full records of ten cases. The autopsy disclosed the characteristic intestinal lesions of typhoid fever, and the histories contained the diagnostic features of this disease. The details are given in my report already referred to. The proof that the disease was typhoid fever was as complete as possible.

The discovery of the communicability of typhoid fever by means of a contagium derived from the alimentary canal, while it furnishes a striking point of distinction from typhus fever, yet shows an interesting point of analogy to the latter disease. In typhus the contagium is doubtless contained in the emanations from the body, either in the breath or in the exhalations from the skin, or perhaps both; and the typhus may be caused, irrespective of contagion, by a morbid matter produced in concentrated emanations from healthy bodies. In typhoid fever, the contagium is in the dejections, and this fever may be, and is generally, caused by a morbific matter produced in decomposing excrement from healthy bodies.

As regards prevention, the diffusion of typhus contagion is to be avoided by the isolation of cases in respect of those who are susceptible, conjoined with the freest possible ventilation. The spontaneous occurrence of this disease is to be avoided by guarding against overcrowding dwellings or apartments, together with complete ventilation. The diffusion of typhoid fever by contagium is to be avoided by the disinfection of dejecta from typhoid patients, and by ample protection against the pollution therewith of water or air. The spontaneous occurrence of this disease is to be avoided by complete protection against the pollution of water or air by the dejecta from

healthy persons. This involves safeguards, especially in cities, relating to sewers, drains, cess-pools, soil-pipes, and the waste-pipes connected with the latter, as well as to the final disposition of the excrementitious material. These safeguards in the city of New York are largely disregarded, and therein is a source of not only typhoid fever, but probably other diseases, the causative connection of which with this source is not as yet so well established.

Within the past few months the interest and importance belonging to the subject of this paper have been curiously exemplified by the diffusion of typhoid fever through the agency of milk. Several outbreaks in England have been imputed to infected milk ; but in the recent instance referred to, the proof of this having been the source seems sufficiently conclusive. This outbreak was in one of the healthiest parishes in the West-End of London. About five hundred cases of typhoid fever were distributed in one hundred and four families in this parish. Of these one hundred and four families, ninety-six were known to have used milk from the same dairy, the facts with regard to the milk supply in the remaining eight families not having been ascertained. It was ascertained that on one of the farms belonging to this dairy there had been cases of typhoid fever, and the sanitary conditions were exceedingly bad. Other details, which I do not introduce, corroborated the conclusion that the diffusion of the disease was due to the milk supply, and no other source was discoverable.[1]

The infection or the contagium in milk is, of course, derived from the water used in washing the milk-cans, and perhaps, in the dilution of the milk. The diffusion of the disease in this way, therefore, is through the medium of drinking-water.

The discovery of the causation of typhoid fever through this medium naturally has led to the inquiry whether other diseases may not be traced to drinking water which either contains viruses of contagion, or is polluted by divers kinds of morbific matter. The facts to which it has been the object of this paper to call attention have opened up a new field for investigation in etiology, and further researches in this direction may shed much light on the causation of numerous diseases. Already, in the opinion of many, there is ground for assuming that epidemic cholera is diffused by means of a contagium, derived from the alimentary canal, with which drinking water is liable to become infected. This opinion is based on analogical reasoning rather than on logical proof. That water polluted by any kind of morbific matter may prove an exciting or an auxiliary cause of an attack of cholera, during the epidemic prevalence of the disease, is highly probable ; but that the disease in this or any other way is communicable, seems to me to be a question concerning which the most to be conceded is that it admits of discussion.

[1] Vide *American Journal of Medical Sciences,* number for October, 1873 ; page 535.

III.

LOCAL AND DOMESTIC SANITARY CARE OF CONTAGIOUS AND INFECTIOUS DISEASES.

REPORT ON THE PRACTICAL LESSONS OF THE RECENT PREVALENCE OF SMALL-POX, WITH REFERENCE TO ITS PREVENTION IN THE FUTURE.

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In reporting on the practical lessons of the recent prevalence of small-pox, with reference to its prevention in the future, little if anything new can be said in addition to what has already appeared in that very able paper of the late Sir James Y. Simpson, entitled "Proposal to stamp out small-pox and other contagious diseases." But in the history of the recent epidemic, in its rapid spread and disastrous consequences when not stayed by judicious preventive measures, and on the other hand, its almost immediate modification and its finally yielding to the controlling influence of sanitary regulations, we find, if nothing new, at least much to corroborate the views and opinions so clearly expressed in that most excellent paper.

The fearful epidemics of small-pox which have from time to time swept over the world prior to the days of Jenner, the extensive area of human suffering, the great loss of life, and the severe commercial disasters resulting therefrom, as well as the protection from the great severity of the disease by means of Jenner's splendid discovery, are matters of history already quite familiar to the medical reader and the sanitarian. It is therefore unnecessary in this report to antedate the recent epidemic, and I shall confine what I have to say to the experience of the last three or four years, as the period during which the triumphs of preventive medicine have been strikingly exhibited through the faithful and persistent application of some of the principles of sanitary science in dealing with small-pox.

While we claim that there is no disease so absolutely under the control of prophylactic measures as small-pox, it is equally true that few diseases are more dreaded, or more serious in their consequences than this, when left to the uninterrupted course of nature; dreaded not only on account of its repulsive character, its large percentage of deaths, the broken constitutions and serious disfigurements of those who recover; but the destitute condition in which the bereaved are often left, the public burden which the relief of their wants imposes, and the stagnation in business which every commercial city to a certain extent suffers during a pestilence, are not to be ignored in

estimating the sad consequences of a long continued prevalence of this disease.

Some four years ago, small-pox, after having spent its fury over portions of the old world, made its appearance on the western part of this continent. The cities and towns of California were visited by the disease, which, assuming the form of an epidemic, displayed a virulence unequaled during many previous years. The inhabitants had for a long time neglected the usual prophylactic measures, vaccination or revaccination, and were therefore not well prepared to encounter the presence of a disease to which this same negligence had rendered them more than usually susceptible; while many claimed that the contagion displayed an increased degree of activity, due only in part to neglect in the use of this simple though sure preventive.

Soon there came to our eastern cities a cry for relief, and large quantities of vaccine lymph were forwarded to supply a deficiency which, when too late, was found to have resulted from what we must now regard as a culpable omission on the part of our western neighbors in thus allowing their own stock of lymph to become exhausted. Meanwhile, the disease finding plenty of material on which to feed, scattered its seeds of contagion in every direction, until arrested, partly by the gradual diminution of the virus, and partly by the protection which late vaccination afforded to those who were enabled to avail themselves of its advantages. Thus continuing its course eastward, it visited both civilized and savage communities, exercising degrees of severity controlled only by the amount of protection which vaccination had previously secured. It is generally believed that during the recent prevalence of small-pox, there was a more than ordinary susceptibility both to the variolous and the vaccine contagion, as shown in the large number of severe cases occurring in persons who had been previously vaccinated; and in the large numbers of successful revaccinations, even among young children whose arms already exhibited what are called "good marks;" and even the many instances of such being the subjects of varioloid long before expiration of the "seven years" after vaccination, during which period immunity from the disease is supposed to exist. The large number of cases of second attack, many of them proving fatal, seem also to support this conclusion.

This strong susceptibility to the variolous poison, even among those who had supposed themselves sufficiently protected, does not in the least militate against the doctrine of vaccination, neither should it in the slightest degree impair the confidence hitherto placed in its protective power; but on the contrary, it adds to, or rather establishes the importance of, its timely repetition, for in a very large majority of persons it is only by revaccinations that the receptivity of the individual for the variolous poison is finally exhausted, and until this is accomplished, whether by one or more vaccinations, no individual can be regarded as absolutely safe, if at any time exposed to the small-pox contagion.

The protection afforded by vaccination, and revaccination properly and timely repeated was, perhaps, never better illustrated than during the recent epidemic, particularly in those cities and towns where the operation had not

been neglected, of which the city of New York affords an example worthy of record. There, even among the most filthy slums and crowded tenements, it has from time immemorial been the practice to secure at least primary vaccination to the children, through the gratuitous services of the physicians connected with the several dispensaries throughout the city, while the private practitioner is by the prevailing custom regarded as bound not to consider the duties connected with the lying-in chamber fully discharged, until he has vaccinated the newly born, and satisfied himself that the child's system has been brought sufficiently under the influence of the vaccine disease. This practice has, for many years past, been so generally encouraged by all legitimate practitioners of medicine, and in a special manner aided by the incorporated dispensaries, each of which maintains its vaccine department, that New York has at all times been supplied with a good and reliable stock of lymph, thus prepared for any emergency, while one of the direct effects of infant vaccination by bringing the subject so often to the attention of families, has been to secure every year large numbers of revaccinations to persons of all ages, from childhood to adult life, from which practice, doubtless, the citizens were so well protected against the severity which the disease elsewhere manifested.

To the work thus yearly performed by the dispensary physicians, and by private practitioners, the health authorities had more recently added their influence and efforts, with a view of affording both to children and adults protection from the approaching contagion; and to these efforts was in a great measure due the modified severity of the epidemic in New York, as compared with its more severe and extended influence in many other cities.

The first active measures adopted by the Board of Health of New York was in the spring of 1869, at which time a system of house-to-house vaccination was inaugurated, and a special corps of vaccinating physicians organized to prosecute the work. This continued through the month of May of that year, during which time about 30,000 vaccinations or revaccinations were performed by a corps of sixty physicians. The result attending this first effort, although not equal in the number of vaccinations to the work of subsequent years, is well worthy of notice as the first successful introduction of house-to-house vaccination in the city of New York, by which the public mind was in a great measure disabused of the opposition hitherto manifested towards this method of applying preventive medicine, and educated to something like a proper appreciation of its importance. It also brought to public attention the subject of vaccination in such a manner that thousands who declined the services of the public vaccinator, applied without delay to their own physicians, or to the dispensaries, and there submitted to the operation.

The action thus early taken had the effect of creating a popular impression in favor of revaccination, and thus not only prepared the way for subsequent efforts, but in a great measure it doubtless contributed to modify the advent of small-pox between two and three years later.

To the protection thus secured was added the vigorous measures adopted upon the subsequent appearance of the disease in a form which threatened to sweep over the entire city, where without unnecessary delay a vaccinating

corps was organized, consisting of a sufficient number of physicians to meet the emergency, by whom the work of house to house vaccination was resumed, and continued until the entire tenement-house population had been thoroughly canvassed. The plan adopted for the prosecution of this work was that of careful house-to-house searching for the unprotected; and in order to reduce it to a perfect system, the city was divided into districts to each of which a vaccinator was assigned for duty, who commenced his labors at some convenient point, calling at each house, visiting each family, not only offering, but in many instances urging the acceptance of gratuitous vaccination. In this manner he passed along from house to house until every tenement-house on the square had been visited. He then commenced on the next square and proceeded in the same manner, and so on until he had completed his district. Whenever a case of small-pox was reported, the vaccinator in whose district it occurred suspended his systematic work and proceeded at once to the house, vaccinated the inmates and those in the adjoining houses, after which he resumed his house to house work where he had left off. To successfully prosecute this work, required on the part of public vaccinator considerable tact, with a good deal of physical endurance; and yet each one faithfully continued in his patient, plodding course until all of the poor had been visited and afforded an opportunity at least of protecting themselves from this loathsome disease. But the work did not stop here, for schools, asylums, factories, printing-houses, stores, and indeed all large places of business, or places where numbers of persons were engaged either in labor or study, were sought out, and the inmates persuaded to avail themselves of this gratuitous offer. As a result of this organized system of sanitary labor, there were, during the years 1871 and 1872, more than three hundred thousand[1] vaccinations or revaccinations performed by agents of the health department alone, which when added to what was done by private and dispensary physicians, swells the amount to an aggregate sufficient to control the spread of the disease by depriving it of so large an amount of susceptible material.

It requires no argument at this late day to prove the efficacy of vaccination in the prevention of small-pox, otherwise repeated instances could be given of the only person in a crowded tenement-house, who refused vaccination, becoming the victim of the disease, while all of the others escaped. But in thus assuming the doctrine of its prophylactic power, we must not forget that in order to enjoy complete and perpetual protection, it is necessary to repeat the operation one or more times, the intervals varying in proportion to the receptivity of the individual for, or the frequency of his exposure to, the contagion. It is advisable, therefore, not to neglect the revaccination of a child that has been exposed to small-pox, for the reason that five or seven years have not elapsed since the date of the primary vaccination, for we shall find nothing more fallacious than the attempt to establish an invariable rule, that vaccination will protect the system from the variolous poison during a certain number of years. As an illustration of this, it may be stated that from March 20, 1871, to March 20, 1872,

[1] Report of the Board of Health for the year ending April 10, 1872, gives 211,258; and that for the year ending April 30, 1873, 100,522.

there were in the city of New York, three hundred and thirty-seven cases of varioloid occurring in children under five years of age, of which number one hundred and thirteen exhibited evidences of having been at some previous time vaccinated, probably in early infancy. Here we have a number of cases, thirty-three per cent. of which were supposed to have been protected, and yet that protection did not extend over a period of five years. As this uncertainty concerning the actual period during which protection is afforded by a single vaccination became apparent, the vaccinating physicians adopted the practice of recommending revaccination to all, both children and adults, who had been in any manner exposed to the variolous contagion, regardless of the number of years that had elapsed since the previous vaccination; and the propriety of this course was fully illustrated in the frequent success of the revaccinations, and the positive protection afforded to all, except in an occasional instance in which the vaccinia was too late to anticipate the variola, and the latter, like the vaccine vesicle in Bryce's test, was developed and ran through its course along with the former, although in a modified form.

I would not be understood to say that of the three hundred and thirty-seven cases of varioloid occurring among young children, one hundred and thirteen had been properly vaccinated; but so far as their history could be obtained from the parents, the appearance of the arm, and the general mild character of the disease, evidence was afforded that at least an attempt had been made to secure full protection, though, as the event showed, not entirely successful. The operation may have been performed in good faith, and as the operator believed, with care and skill; but the lymph may have been of an inferior quality, it may have been taken from an imperfect vesicle, or it may have been carelessly applied. And here it may be remarked that the collecting of lymph, though generally regarded as a simple operation, requires more judgment and skill than is generally supposed. The operator should be competent to judge of the condition and constitution of the child, of the quality of the vesicle, and having settled these points, it next requires the exercise of extreme care to so open the vesicle as to receive from it nothing but the pure lymph it contains.

I am aware that many experienced vaccinators and careful observers still entertain the opinion that a single proper vaccination will protect the system through the periods of infancy and childhood to that of puberty; while some even contend for its unlimited efficacy. Now without even raising a question in regard to the soundness of this doctrine, it may be asked with propriety, how are we to decide in a transient population, like that of our tenement-house districts, of the value of any previous vaccination, unless we have had the opportunity of watching the progress of the vaccinia through its different stages? We cannot place implicit reliance on the appearance of the cicatrix, neither can we learn from the parents anything satisfactory regarding the degree of febrile action attending the disease, nor even of the vesicle itself, as to its characteristic appearance. At the same time it must be acknowledged that many physicians who are intrusted with this duty, are not thoroughly alive to the importance of a careful observation

at the proper time. In a large majority of cases, particularly among the poorer classes, if the child is not brought back to the physician or to the dispensary for inspection, on the seventh or eighth day after vaccination, it is probably not seen at all, and only such evidence as can be obtained from the parents, or from the appearance of the mark, is had upon which to base an opinion as to the genuineness of the vaccinia. It is the practice of the dispensary physicians to require of the parents or guardians of the child to be vaccinated, the deposit of a small sum, to insure the return of the child at the proper time, that the physician may be enabled to judge of the success of the operation, and to procure from the arm a fresh supply of lymph for further use, but a fear of injury to the child by interfering with the vesicle is so strong in the minds of many parents, that they willingly forfeit the small amount deposited, rather than subject the little one to this imaginary danger, satisfying themselves that the sore arm is sufficient evidence of a genuine vaccination. Admitting then that what may be regarded as a genuine vaccination exerts its prophylactic power to the age of puberty, or even indefinitely, the frequent uncertainty that the primary vaccination has been of the character desired, should make us cautious in placing full confidence in the evidence produced two or three years after; for if among the three hundred and thirty-seven cases before mentioned, one hundred and thirteen of them were within five years of their primary vaccination, and this in the city of New York where infant vaccination and the preservation of a good stock of lymph are regarded as among the special duties of the medical profession, it is evident that the operation has been in these instances carelessly performed, or that there are some exceptions to the unlimited continuance of its prophylactic power. In either case the doubt is easily and safely solved by applying the unfailing test of revaccination; and I might add that since this practice was adopted, no case of small-pox has occurred among those who were revaccinated immediately after exposure to the contagion. There are doubtless many in whom this receptivity is quite exhausted by a single vaccination, while other systems are so susceptible that several repetitions are required to obtain this result; and I think we may add, that one of the practical lessons is found in the propriety of repeating the operation on all who are exposed to the disease, until at least one or more efforts have failed to produce any characteristic result.

The practical lesson in regard to the sanitary care of the sick, may relate, first to the safety of the patient, and second to that of the public; the latter being the peculiar duty of the sanitarian and the health official. Concerning the patient, the usual sanitary care common to other contagious diseases should be observed, as proper regulation of temperature, clothing, ventilation, food, drinks, etc., matters wholly under the direction of the medical attendant, and of which here a mere mention must suffice. In regard to the protection of the public, a serious duty devolves upon the sanitary authorities, for, as the interests of the patient and of the public often appear to conflict one with the other, we claim that when such is the case, the wishes and interests of the one should yield to the welfare of the many. With a view of preventing the communicating of this contagion to others, it is essential that

the patient be so isolated as to absolutely preclude at all times, the presence of any one except the nurse, who should also be cautioned against intercourse with others while in the discharge of this duty. It is not only for the safety of friends that would be likely to come in contact with the patient that isolation is necessary and its observance enforced; but it is well known that such persons may be the vehicles by which the infection is conveyed to others, while they themselves escape; and as a public safeguard, it is equally important that the protected as well as the unprotected be rigidly prevented from any personal communication with those who are suffering from this disease. We all know that this infection may be conveyed from place to place by clothing; it adheres to bedding, carpets, upholstered furniture, and plastered walls; and even the physician in his brief visit, without due precaution may convey the infection to the next patient who may require his services. It is of importance therefore that the physician in active general practice, particularly the obstetrician, decline to attend patients sick with small-pox. Mild cases seldom need medical care, while persons having the disease in a more severe form should be otherwise provided for; and here arises the question of removing patients from their homes, and placing them in hospital for treatment, a practice which, however disagreeable to patients and their friends, is nevertheless necessary in a large majority of cases if we would deal successfully with this disease.

According to our experience, it is not safe to allow a case of small-pox to remain in a house occupied by other persons who are daily mingling with the busy world, unless there be facilities for perfect isolation. Therefore, tenement-houses situated in large cities and visited by this disease, become pest-houses, to some extent at least, from the fact that the necessary isolation of patients cannot there be enforced. People who occupy this class of dwellings are, as a rule, ignorant of the danger they incur, or are heedless of its consequences, and hence feeling themselves secure by vaccination, or by having had the disease at some previous time, they without hesitation expose themselves to the contagion, to the serious detriment of some person with whom they may afterwards be in communication. That no case of small-pox can be traced to a patient sick with the disease and allowed to remain in a house of this description, however great the effort at prevention, has been with us the exception rather than the rule; and hence it is with us a practice seldom varied, to cause the removal of such patients to hospital with as little delay as possible. The exceptions are those cases in which it is feared that death may take place during removal, the case of a puerperal woman, or of a uterine hemorrhage. These cases are always attended with extreme danger which we do not care to enhance by the excitement and fatigue attending the act of removal.

That the case is a mild one, is, if possible, a stronger reason in favor of removal, from the fact that such patients cannot be properly controlled at home. Feeling that they are not sick, they are impatient at what they consider an unnecessary confinement, and recognizing the interests of none but themselves, they if possible conceal the malady, and mingle indiscriminately with others, regardless of all consequences. By this class of patients, it is

believed, public conveyances are often infected, and even a public assembly may have in its midst, in the form of a convalescent, or a mild case of variola, the forces of what may subsequently prove a widespread infection; or what, to use the simile of Sir James Y. Simpson, would destroy more lives than would a tiger or a rattlesnake suddenly appearing in their midst.

The effort to isolate a patient, sick with small-pox, in a tenement-house, renders it necessary that children and others residing in the same house, refrain from attending school, or church, or other public gatherings, until the time for conveying contagion has expired, and the premises have been thoroughly purified. It has been our custom, therefore, to notify teachers of the presence of this disease at the homes of any of their pupils, that they may take the necessary action, and see that for the time being the exposed ones are excluded from school. The same system of exclusion should extend to those whose occupations cause them to mingle much in the company of others. When we remember that many occupants of tenement-houses are engaged in crowded workshops and factories, in the manufacture of clothing, at their residences, or in otherwise handling material to which contagium may adhere, we must at once see the danger incurred in allowing a single case of small-pox to remain in one of this class of dwellings.

We should not only quarantine the patient, but we should immediately adopt measures to destroy the infectious poison; and for this purpose nothing has proved more efficient with us than diffusing through the atmosphere of the room, and of the adjoining halls, the vapor of carbolic acid so diluted that the vapor can be respired without serious annoyance. This may be done by suspending in different portions of the room, cloths wet with a solution of carbolic acid, about two ounces to a gallon, allowing it to slowly evaporate; or it may be done by means of an atomizer, throwing from time to time a spray of the solution into the room, and around the patient.

Frequently anointing the patient with an ointment of which carbolic acid forms one of the ingredients is also an efficient means of destroying or limiting contagion, both by the disinfecting properties of the acid, and the effect of the ointment in preventing the escape of dry particles of animal matter from the cutaneous surface into the atmosphere of the room during the period of desquamation.

The proper treatment of clothing and bedding is next in order, and the disinfecting solution recommended, being the same which is adopted by the Health Department of New York, has been frequently published, and must be familiar to all present. It consists of one ounce of carbolic acid, eight ounces of sulphate of zinc, and three gallons of water. In this solution, all articles of soiled clothing, etc., are to be soaked for one hour, after which they are to be boiled and then washed. Articles of bedding, etc., that cannot be disinfected are to be burned. Attendants should be directed to keep portions of the same solution in vessels which are to receive the saliva and other secretions and evacuations of the patient, while privies and water closets are to be disinfected with much stronger preparations. After removal of the patient, or the termination of the case, be it recovery or otherwise, the room which he occupied should be thoroughly fumigated with the fumes of

sulphurous acid, developed by the burning of roll brimstone. The method of conducting this operation, adopted by the Metropolitan Board of Health in 1866,[1] has recently been given to the public by authority of the present Municipal Board, from which I quote: "The doors and windows being tightly closed, after the bedding and clothing have been suspended in some manner, so as to allow free access of the fumes, from one to three pounds of sulphur are placed upon some metallic vessel, so as to avoid the danger of fire, a little alcohol poured over it, and then set on fire, the operator immediately leaving the room and closing the door tightly so as to prevent the escape of the fumes as far as possible. This is allowed to burn out, and thus liberate large volumes of sulphurous acid. After two hours the doors and windows may be thrown wide open, and the room thoroughly ventilated by the free admission of air. Experience has taught us that these means have proved, when thoroughly done, to have destroyed the infection which has been in the apartment. Carbolic acid and sulphurous acid seem to have the property of destroying the germs of this particular poison, while chlorine, so much relied upon as a disinfectant heretofore, does not prove to have the same power."

In addition to fumigation, the walls and ceilings of the room are lime-washed, the wash containing a proportion of carbolic acid, or in the case of painted walls, they are washed with carbolic soap.

In the event of death, the body is immediately wrapped in a sheet saturated with a solution of carbolic acid, and with as little delay as possible, placed in a metallic coffin which is then tightly closed, and at once buried. No funeral gathering is allowed. This in brief is the method of dealing with small-pox adopted by the health authorities of New York, and which has stood the test of the two years during which the disease has been more or less prevalent in that city. By firmly adhering to these regulations, the authorities have been able to so control the disease that in comparison with other cities where it has assumed an epidemic form, it has been the least severe in proportion to the numbers and condition of its population.

But we need more legislation to facilitate our endeavors to cope with this disease; for although proper vaccination is regarded as a valuable preventive, there is in every large city a sufficient amount of opposition to, or of popular distrust in the efficacy of, vaccination to prevent our obtaining at all times perfect results. We are, perhaps, not yet prepared for such legislation as will authorize compulsory vaccination, and yet the difficulty may be indirectly met by the passage of appropriate laws. We may follow the example of Austria and prohibit the entrance of a child into any educational establishment whether public or private, unless evidence is furnished of satisfactory vaccination. The charters of colleges and higher institutions of learning might contain the same restrictions; and all public aid might be withheld from families that are not — each and every member — protected by having undergone this operation. Again we may copy the Compulsory Vaccination Act of England by making it a penal offense on the part of parents to neglect the vaccination of their children.

All charities of whatever class or kind, the proprietors of factories and

[1] See *Report of Metropolitan Board of Health*, 1867: *Appended Statement VI.*

workshops, or of any and all establishments where large numbers of persons are employed, may be required by legislative enactment to see that all their employées or persons depending upon them are satisfactorily vaccinated, and all marriage licenses may be withheld until parties seeking to contract marriage afford similar evidence of protection.

Legislation authorizing health authorities to remove to appropriate hospitals all patients dangerous to the public health exists in many of the States, and should be provided for all, on the principle that individual preferences should at all times yield to the interests and safety of the public. As in time of war every man owes his life to his country, so in time of pestilence should individual wishes be sacrificed to the public welfare.

Legislation should not only authorize the removal of patients, but it should prepare for them such places of reception as will be to them comfortable and attractive rather than the gloomy and repulsive surroundings which generally characterize the pest-house. The sick man is unfortunate in his sickness, but doubly unfortunate is he when his disease is of that character which renders him an object of disgust to all around him, and which for the time being, necessarily removes him from society and friends, and causes him to feel that he is an outcast and a pest. We should not now desire to add to his misery by removing him to the common pest-house crowded with patients of every grade and description, there to be nursed by some convalescent pauper or invalid criminal, to whom his recovery or death is a question of not the slightest consequence. The small-pox hospital should be constructed on the most liberal scale. It should be so far isolated from other occupied buildings, as to afford out-door exercise for convalescence; its wards should be roomy, well ventilated, and at all times scrupulously clean; a commodious library and reading-room with facilities for in-door games and amusements should constitute one of its distinct features; the nurses and attendants should be persons of good character, intelligent and well trained in a knowledge of their peculiar duties; and the patient should be induced to feel that while compelled to leave his home and be treated, for the time being, as an exile from society, he is going to a haven of rest, where the comforts, with the kind sympathy of those around him, will at least partially compensate for his temporary absence from his home and his friends. With such accommodations for persons sick with this loathsome disease, removals could be effected with much less opposition on the part of patient and friends, and the public health would be far better protected than it is under our present imperfect systems.

Legislation authorizing local and State Boards of Health to furnish applicants at all times and all places with fresh vaccine lymph, is much needed as an important provision against the spread of small-pox. Such legislation should provide for the establishment of vaccine bureaus in connection with health organizations, to be under the managements of persons of experience and acknowledged skill, who should be intrusted with the duty of affording gratuitous vaccination wherever and whenever required, to collect and preserve lymph, and to distribute it from time to time in such a way as to best contribute to the protection of the public health. And these advan-

tages should not be limited to towns and communities, but should be extended freely and broadcoast over the land, for in these days of rapid and frequent communications of persons from remote portions of the country, the presence of a pestilence in an obscure and distant hamlet, is not altogether a matter of indifference to the commercial emporium, so long as our great arteries of travel, in their various ramifications over the country, may at any time convey to or from us the seeds of the prevailing disease. Money and labor thus expended in protecting the country from the outbreak of any dreaded pestilence, will save to the country both human life and human labor, will prevent pauperism, preserve commerce and trade, and in short will prove to be an effective stroke of political economy.

PLAN OF A HOSPITAL AND CLEANSING ESTABLISHMENT FOR THE TREATMENT OF CHOLERA AND GUARDING AGAINST ITS INTRODUCTION AT PORTS AND PLACES OF ENTRANCE.

By WILLIAM MARSDEN, M. D., of Quebec,

President of the Canadian Medical Association of the Dominion.

The following plan of Quarantine for Asiatic Cholera, is the result of a special study of the etiology and pathology of the pestilence, which six distinct visitations have afforded me, during the last thirty-four years.

It is no part of our present design to discuss the question of contagion or non-contagion; the proposed plan being founded on the hypothesis that Asiatic cholera is a *portable, controllable, and communicable* disease; and like the plague, may be *transmitted* and *communicated*, both by persons and personal effects.

The basis of the plan is therefore *absolute non-intercourse*, for a short period, with persons from abroad suspected of being infected; and a thorough disinfection of personal effects.

I assume the principle, propounded by Kennedy in his "History of the Contagious Cholera," that the peculiar variety of cholera that has visited various parts of the world, during the past half century, is identical with that which broke out in India in 1817, and "assumed a contagious property which there is no evidence to prove it ever before possessed."

Opportunities of investigating facts connected with the disease on this continent, have been extensive and ample; and we have been enabled, from personal observation and inquiry, to trace the introduction of the disease into this country, on each occasion, to *importation from infected places.* Its subsequent diffusion throughout the British Provinces and the United States, has also been strongly marked by the ordinary characteristics of infection, notwithstanding the statement of individual writers to the contrary.

PLAN FOR A CHOLERA QUARANTINE STATION.

1. The Cholera Quarantine Station shall be divided into three separate and distinct sections or departments.

2. Each of these three sections or departments shall be isolated and separated from one another, by a *cordon* or portion of neutral ground, of not less than one hundred feet wide.

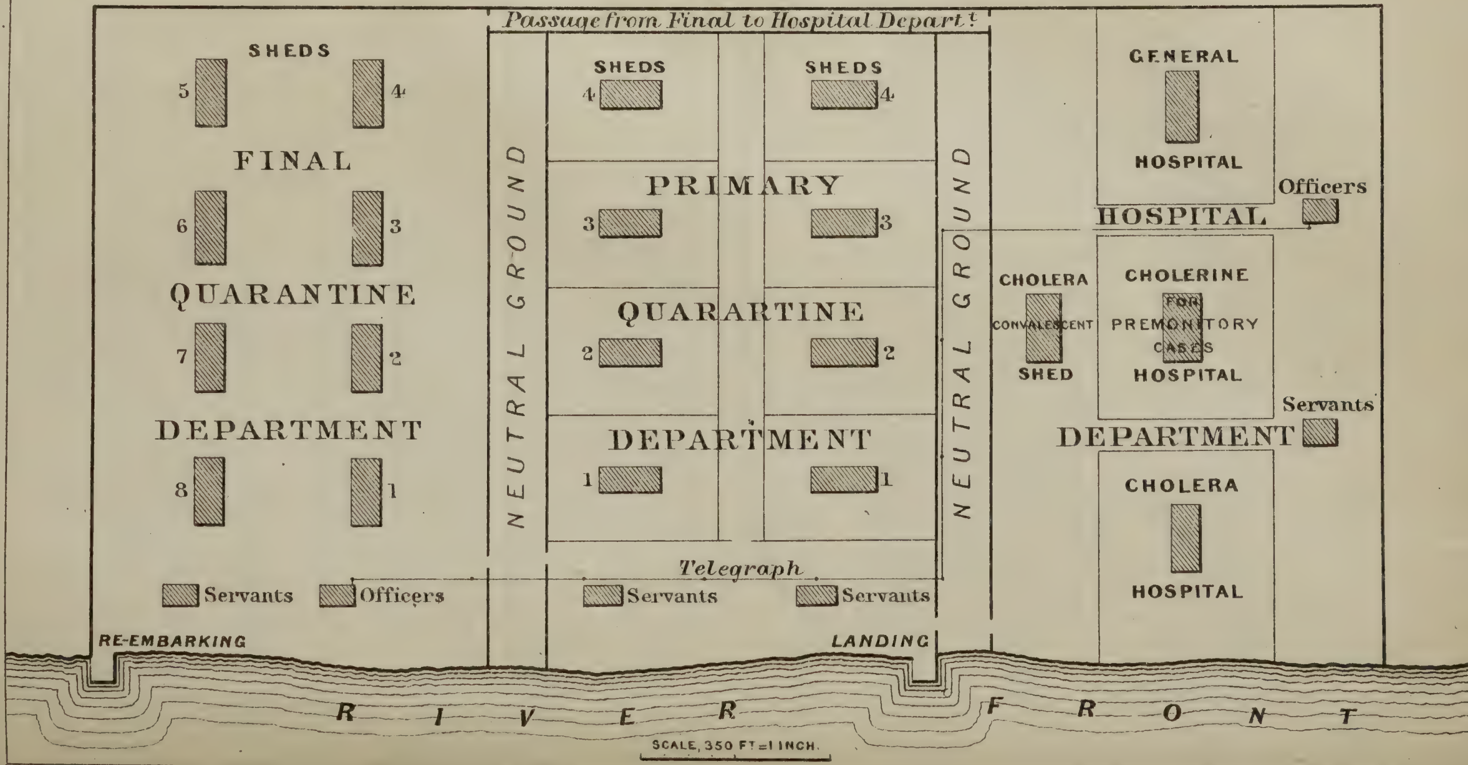
a. One of these sections or departments shall be appropriated to the use of the sick, and shall be the Hospital Department.

b. The next or central section or department shall be devoted to the use of passengers who have not had cholera, but have been on board of infected vessels.

c. The third or healthy section or department, shall be appropriated to the use of the well passengers who have been removed from the central department, after having performed quarantine there.

A. In the first section or department there shall be three separate and distinct hospitals, besides a convalescent shed or hospital.

Dr. MARSDEN'S
PLAN OF CHOLERA QUARANTINE STATION.



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a. The one for confirmed cases of cholera to be called the *Cholera Hospital.*

b. Another for cases of choleraic diarrhœa, or other premonitory symptoms of cholera, to be called the *Hospital for Cholerine.*

c. The third for all diseases other than cholera, or cholerine, originating on board of infected vessels, or vessels having had cases of cholera on board, to be called the *General Hospital.*

B. The next or central section or department, shall be the Primary Quarantine Department, and shall be appropriated to all persons who are not sick, but who come from vessels having cholera on board, wherein every case on landing shall undergo inspection, washing, cleansing, and purifying, both of person and personal effects. There a quarantine of four days shall be performed, at the end of which period all who continue in sound health, shall be removed to the Final Quarantine Department, and any who may fall sick, or be threatened with sickness during the four days of probation, shall be removed to the proper hospital in the Hospital Department. Thence, also, the healthy inmates shall be removed daily to a new locality, thus occupying four different habitations during their sojourn. The washing, cleansing, and purifying, or destruction of personal effects shall take place as near the landing-place as possible, for which purposes suitable buildings shall be erected.

C. The third, or healthy department, shall be the Final Department, and shall be for all cases coming from the Primary Quarantine Department, after having been cleansed, washed, and disinfected, and after having undergone the *four days'* quarantine; and here a further quarantine of *six days* shall be performed (excepting cases coming from the convalescent hospital or shed, hereinafter provided for), making in all *ten days* of quarantine, when all persons continuing healthy shall be discharged from quarantine, and be removed from the station. If any premonitory symptoms or other causes of sickness occur in this department, during the six days of quarantine, they shall, as soon as discovered, be removed to the proper hospital, in the Hospital Department.

No communication shall take place with the Hospital Department, except through the Central or Primary Quarantine Department, for which purpose a passage, unfrequented by the persons undergoing quarantine, shall be set apart and reserved.

The three sections or departments above described shall be designated and known as: —

1. *The Hospital Department.*
2. *The Primary Quarantine Department.*
3. *The Final Quarantine Department.*

RULES FOR PILOTS.

1. All vessels coming from infected ports, and having, or having had cholera on board, shall be brought to anchor abreast of the Central or Primary Quarantine Department or station.

2. All vessels coming from ports known to be infected by cholera or not, and not having or having had any case or cases of cholera on board, shall be brought to anchor abreast of the healthy or Final Quarantine Department, or station, where and when they shall be boarded by the Medical Officer of that Department, and he shall have power either to discharge them from quarantine forthwith, or detain them, if he finds sufficient çause for so doing.

OF LANDING AND REËMBARKING.

a. The landing of passengers and their effects shall take place at the Primary Quarantine Department *only.*

b. The reëmbarking of passengers and their effects shall take place from the Final Quarantine Department *only.*

1. On the landing of passengers from shipboard at the Primary Quarantine Station, the sick shall be forthwith removed to the Hospital Department, and the well to the place assigned to them, in the Primary Quarantine Department.

2. The sick shall be borne upon litters and placed within the neutral limits about midway between the Primary Quarantine and Hospital Departments, by the persons who bring them ashore, who shall then retire to the Primary Quarantine Department (unless they be seamen belonging to the vessel, in which case they shall return aboard ship) ; whereupon persons from the Hospital Department shall enter the neutral ground, and remove them to the proper hospital.

3. There shall be in the Hospital Department, at a reasonable distance from the Cholera Hospital, a shed or building for cholera convalescents, where they shall remain at least for *four days* previous to being removed to the Primary Quarantine Department, and where a quarantine of *four more days* shall be performed after cleansing, washing, and purifying, previous to removal to the Final Quarantine Department, where *two more days* of quarantine only, instead of six, shall be performed, making in all *ten full days* after leaving the Cholera Hospital, when, if the patient continues healthy, he or she shall be discharged.

4. Persons having completed their period of quarantine shall be removed at once from the Quarantine Station, by steamers chartered for the purpose, and shall proceed directly on their journey.

5. Provisions, stores, clothing, bedding, and all other necessaries or supplies for the Hospital Department shall be conveyed within the hospital limits under the same regulations and restrictions as persons.

6. All physicians, orderlies, servants, nurses, attendants, etc., connected with the Cholera Quarantine Station, as also all persons performing quarantine, shall remain and be kept constantly in the department or section to which they have respectively been assigned, and none of them shall, under any pretext whatever, be permitted to have any communication or intercourse whatever, directly or indirectly, with persons from another department or section, excepting in due course of quarantine.

7. Any employée, nurse, or orderly belonging to the Quarantine Station who may be found violating the above rule, shall be liable to suspension from office, with forfeiture of salary and emoluments, or dismissal from office, at the discretion of the Medical Officer in charge, or of the Superintendent, besides being obliged to undergo such quarantine as the nature of the contact or exposure may warrant.

8. Any person violating the above rule by going from the Final Quarantine Department to the Primary Quarantine Department, or from either of these to the Hospital Department, shall, on detection, be detained in the Department they have visited in violation of the law, and shall there undergo quarantine anew.

9. All persons permitting the approach of persons from another Department, excepting in due course of quarantine, will render themselves liable at the discretion of the medical officer, to be sent back to the Department to which the person so approaching them belonged, and shall undergo quarantine anew.

10. The three Quarantine sections or departments shall be separated from each other, and bounded by a *cordon* or strip of neutral ground, of at

least one hundred feet in width, and shall be surrounded by a strong fence of at least seven feet high.

11. Between the Final Quarantine and Hospital Department, at the extreme end of the Primary Quarantine Department there shall be a *cordon* or passage or portion of ground, of at least thirty feet wide, with a close fence of seven feet high, to be used exclusively as a passage from the Final to the Hospital Department, for the return of patients to the Hospital Department if necessary.

12. Each of the subdivisions in the Hospital Department shall be surrounded by an open fence of seven feet high.

13. Each of the subdivisions in the other departments, and especially in the Primary Quarantine Department, shall be surrounded by a close fence of seven feet high.

14. Each of the before mentioned departments may and shall be subdivided, in such manner as circumstances may require; and as near as practicable in accordance with the accompanying plan.

15. The place of landing in the Primary Quarantine Department shall be as near the Hospital Department as convenient, and as far removed as possible from the place of departure or reëmbarkation, in the Final Quarantine Department.

16. There shall be telegraphic communication between each of the Departments, with a telegraph operator attached to each.

Among the additional details of our plan, the following is most important: —

A *perpetual* stream of water shall be caused to flow through all the water-closets, cess-pools, drains, etc., which shall empty at low water-mark, and such other disinfectants and deodorizers as science may suggest and necessity dictate, shall also be used.

IV.

SUMMARY OF EVIDENCE AND LOCAL REPORTS UPON CHOLERA, AS IT HAS PREVAILED IN THE MISSISSIPPI VALLEY AND ELSEWHERE IN AMERICA, DURING THE YEAR 1873.

REPORT OF CHOLERA IN NEW ORLEANS, LA.

By C. B. WHITE, M. D.,

President of the Board of Health of Louisiana.

These memoranda consist of a history of the first twenty-five cases of cholera, or cholera morbus, of official papers relating to the question of the importation of the disease, some observations on its nature, some upon the meteorological conditions present, as well as some of a general nature believed to have a general interest in connection with the topic under consideration. With these memoranda, are submitted a map of New Orleans, showing the localities of all deaths by cholera or cholera morbus, together with a chart showing the total weekly mortality, the weekly mortality under five years, the weekly mortality from cholera, and the meteorological conditions during the first six months of 1873. Also a chart showing the oscillations of subsoil water in New Orleans during the same period.

In preparing the notes of all the cases whose history follows, very careful inquiry was made as to importation, portability, and infection. The inquiries embraced all particulars with reference to contact with passengers and their baggage, the washing of clothing from persons on shipboard, etc., etc. The few missing numbers on the map are of cases reported "homeless," *i. e.* persons either sleeping about the wharves, or brought to hospital by the police in a dying condition and unable to give their history. Those of the deaths occurring at the Charity Hospital whose history could be ascertained are referred to the locality where taken sick. The map contains all the cases of cholera and cholera morbus embraced in the record of the Board of Health, which is almost wholly a record of deaths. By whatever name called, the disease is doubtless the same, the distinction in name being a distinction without a difference.

In the investigation of the cases, careful inquiry was made as to the importation, portability, and infectiousness of the disease, and embraced all particulars with reference to contact with passengers, or their baggage, the washing of clothes from persons on shipboard, etc.

The first death of the disease occurred February 9, and the last November 21. Only seven cases occurred in the last six months of the year.


MAP
OF
NEW ORLEANS
showing the
LOCATION OF EACH CASE AND GROUP
OF
CHOLERA
as it prevailed in 1873.
To accompany Report by
C. B. WHITE, M.D.
Pres.t Board of Health
The numbers within city blocks enumerate the cases in the order of occurrence.
MISSISSIPPI RIVER
Race Course
FAIR GROUND
FLORIDA
WALK
CITY of JEFFERSON
NEW ORLEANS
AVENUE

Case No. 1. — Peter Thomson, a sailor, said to be a German, aged fifty-six years, died of cholera, February 9, at 39 Ferdinand Street.

Thomson went to Pensacola, Florida, Galveston, Texas. At Pensacola, finding no work, he left his children, and came to New Orleans, *two months* before his illness. He found no work until two days before his death, at which time he began to assist in discharging general cargo from a Liverpool vessel, one and one half blocks below the head of Ferdinand Street. Four squares below lay a Bremen bark. At 2 P. M., of February 8, the second day of his labor, he was taken sick, and died at 9 A. M., the next morning, February 9.

Eight other men who worked on the levee with him, boarded in the same house. None of these suffered from the disease. There had been no sickness on the ship.

No other case of cholera occurred in this vicinity until May 20, case No. 192 of the record, distant in space one and one half blocks in direct line, and distant in time one hundred days.

Thomson was a temperate, steady man. The attending physician reported the case one of sporadic cholera, in his opinion, caused by eating largely of cabbage, while suffering from diarrhœa.

Case No. 2. — Justice Coig, native of France, aged twenty-six years, died February 10, of cholera morbus, at the corner of Hancock and Levee streets, a point two squares above the United States Barracks, and about *two miles* distant from the locality of case No. 1.

This man was a butcher, a hard drinker; occupation, slaughtering beeves for his brother, at the Abattoir, just below the Jackson Barracks.

He was taken sick during the night of the 9th of February, and died on the morning of the 10th. He had resided in the city four years, living with his brother at the locality mentioned; had not been absent from home, save at work, for some time, and had visited no ships. No ships lie near that part of the city.

Surgeon R. S. Vickery, U. S. A., who was called to attend him, says: "I found him in bed, in a cold, barn-like loft, in a place used for storing green hides. He was in a state of collapse, cold extremities, pinched features, speechless or nearly so. . . . .

"From a comrade who had been with him a part of the time, I learned that he was seized in the night with an attack of bilious cholera, which soon passed into serous vomiting and purging. This had ceased from exhaustion before I saw him, and the evacuations had all been thrown away." Dr. Vickery attributed the fatal termination of the case partly to the extreme cold of the weather.

Case No. 3. — Joseph Honoci (creole), colored, native of the State, speaking French, aged fifty-two, died February 28, of cholera, on Dumaine Street, between Roman and Derbigny streets.

This death occurred eighteen days after the death of case No. 2, in a locality far removed from either of the first two cases, and having no connection with either of them.

Honoci was employed as a laborer, unloading the *Belle Lee*, a river

steamboat, at the head of Canal Street, on February 27, came home that evening, and died the same night at twelve o'clock.

The sister and wife of Honoci, his brother-in-law, and three children, occupied the house, which Honoci owned, with the deceased. No other case occurred on the premises, and none in that vicinity, until May 13, case No. 152 of the record.

Case No. 4. — Hannah Nelson, female, black, aged twenty-one, died March 1, of cholera, at 166 Franklin Street.

Whilst returning from the funeral of her husband on the afternoon of February 28, she became too ill to go to her residence, 55 Burgundy Street, and stopping at the house of a friend, remained there until her death, which happened the next day.

The husband, Edward Nelson, by the neighbors was stated to have died by disease similar to that of the wife. His physician gave a certificate of death by acute gastro-enteritis, and upon after inquiry being made, insisted on the correctness of the diagnosis already given.

Nelson came into the city on the Mississippi River boat *R. E. Lee*, February 24; worked on her during the 25th, and until 3 P. M., of the 26th, at which hour he was carried home, and died the next morning. The premises were in good condition, seven rooms, six occupants. No one here had anything to do with shipping. Nelson visited no other parts of the city between his arrival and death.

Case No. 5. — Margaret Woods, female, black, four and a half years of age, died of cholera morbus, March 2, at 533 Goodchildren Street. In the same house, on March 8, died No. 10 of the record, Isabella Woods, her sister, aged two and a half years.

On March 1, Perry Scott, uncle of these two children, living at the same place, died, and was buried by the Coroner, who gave a certificate of death by diarrhœa. He, however, had the body interred in haste, giving as a reason that Scott had died of a dangerous disorder, and the safety of the community required speedy burial. The case was not reported to the Board of Health, and the facts stated were elicited in the investigation made of the Woods' cases. Scott was a laborer on the steamboat levee.

The house where these cases occurred was small, crowded, with a very foul privy vault. This was disinfected, and the premises vacated. No other deaths occurred in this immediate vicinity for the next ninety days.

Case No. 6. — Robert Banks, male, black, aged fifty years, died of cholera, March 3, corner of Prytania and Polymnia streets.

Banks kept an eating-house on the levee, near Canal street, went to his business in the morning, and died at two P. M. of the same day. No circumstances connect this case with the shipping. The premises in which he lived and died were in bad sanitary condition, the house old and leaky, stable filthy, privy vault overflowing into yard. The premises were disinfected, vacated, and remain unoccupied. Case No. 22 occurred five blocks distant and twenty-eight days later. Case No. 36, two blocks distant and forty days later. No connection between the two cases traceable.

Case No. 7. — George Williams, male, black, twenty-nine, taken sick

March 2, at No. 59 Erato Street, removed to Charity Hospital, died March 4 of cholera morbus.

Williams came to the city from one of the Red River parishes fifteen days before his death, worked on the steamboat levee, unloading barges from St. Louis, one of which he "pumped out" the night he was taken sick. He did not lodge at 59 Erato Street, but somewhere about the New Basin.

Case No. 8. — Daniel Donovan, white, male, native of Illinois, aged eighteen years, "homeless," admitted to Charity Hospital March 3, died March 6, of cholera morbus. Came from Natchez, Mississippi. Had been in the city *five* (5) days.

Case No. 9. — Mrs. Nairnes, thirty-four, died March 8, of cholera morbus, at 132 Dryades Street.

Previous to the sickness of Mrs. Nairnes, the husband, by trade a tailor, had an attack said to be similar to that of the wife, but recovered. After the death of Mrs. Nairnes their child was attacked, and recovered.

The habits of both husband and wife were bad, the latter being reported a hard drinker.

The family had no connection with either boats or shipping. The premises are unhealthy, being low and damp. Stagnant and filthy water was found in the yard. No 12 was three blocks distant from this place, but no connection existed between them.

Case No. 10. — Isabella Woods, black, aged two and a half years, died of cholera morbus, at 533 Goodchildren Street, a sister of case No. 5. The history has already been given.

Case No. 11. — Frank Baisey, male, black, forty-five, died of cholera morbus, March 7, at 308 Perdido Street.

Baisey was employed on the steamboat levee; had not been at work the day upon which he was taken sick. His physician attributed his attack to an immoderate meal of pig's feet eaten just before going to bed at night. He had visited no sick persons. His child, wife, and another woman living in the house did not have the disease. No connection with shipping could be ascertained.

The premises were in good order, lot well filled, yard paved. The location is back of Galvez Canal, one of the foul draining ditches of the city, and subject to both swamp and sewage poison.

Case No. 12. — James Johnson, male, black, aged sixty years, died March 10, of cholera, at the corner of Lafayette and Basin streets.

Diarrhœa for a week preceded the marked symptoms of cholera.

Johnson occupied a room extending over a portion of the privy vault, the odors of which came up through the floor, near which he slept upon a low bed. By the attending physician his illness and death were attributed to the effects of the poisonous air from the vault.

Johnson was a laborer on the steamboat levee. No connection could be traced with shipping. No other case occurred here.

Case No. 13. — Charles Higgins, black, one year, died March 15, of cholera morbus, at the coroner of Dauphine and Marigny streets.

The child and mother have been living on the premises for *five months.*

Neither the mother, the two remaining children, nor the six other persons living there, suffered with the disease. No connection with the shipping ascertainable.

Case No. 14.—Mary Adams, female, mulatto, two years of age, died March 23, of cholera, at 128 Toulouse Street.

The premises, although containing fourteen rooms, occupied by twenty-six persons, were in good sanitary order.

Case No. 15.—Kate Duane, white, aged seven, died of cholera morbus, March 28, on Claiborne Street, between Cypress and Lafayette streets.

Her illness lasted twenty-four hours.

The father of the child drove a grocery wagon, had nothing to do with shipping. No connection with suspicious persons or places could be traced.

Three other persons occupying the premises escaped similar illness.

Case No. 16.—William Brady, white, forty years, "homeless," two days in the city from Texas, admitted to the Charity Hospital March 30, and died the same day. Certificate, cholera morbus.

Case No. 17.—William Johnson, white, male, twenty-three years, died of cholera, March 30, on steamboat *Sabine*, just from Ouachita River, lying at the foot of Custom-house Street. Certificate of Coroner. No history could be ascertained. His death occurred on the same day on which the boat arrived in the city.

Case No. 18.—Isidore Naines, black, male, twenty-six years, died of cholera, March 31, at No. 76 Treme Street.

Naines was a steamboat man, had been running in the Ouachita River trade for a month previous to his illness, and upon the steamboat *Sabine*, as had Johnson—case No. 17.

He was taken sick the day the boat arrived in port, dying the next day at 3 P. M. No other cases occurred at the locality of his death.

Case No. 19.—Sarah Jackson, three and a half years, white, died of cholera, March 31, at No. 146 Chartres Street.

Case No. 20.—Henrietta Jackson, sister of Sarah, white, five years, died at the same house, of the same disease, the next day, April 1.

These cases had no connection with the levee, or with suspicious persons or places. The premises were filthy, and abutted on the foul and offensive vaults of a row of tenement cottages, at that date, not reached by the annual house-to-house inspection.

The vaults and premises of this and neighboring houses were disinfected. No other cases in the immediate vicinity.

Case No. 21.—Louis Davis, white, thirty-five years, died of cholera, April 1, at 17 Jackson Street.

Davis was a sailor, had been living four months at the locality named. Just before his death, the day of the attack, he had been employed shifting ballast in the hold of the ship *Research*, from Galveston.

Case No. 22.—Charles A. Wilson, white, thirty years, died April 1, of cholera, on Prytania, near Jackson Street, a grocer, a man of means, living in the best portion of the city, having had no connection with shipping, nor with infected places or persons. He had committed serious errors in diet

the day preceding his attack, which terminated in death in twelve hours. No other members of the family attacked. No other case occurred within six blocks, save No. 182 of the record May 16.

Case No. 23. — George Patterson, black, forty-five years, laborer, died March 30, of cholera, at No. 5 Theresa Street.

Patterson had been working at Hoelzel's corn-mill, corner Tchoupitoulas and Calliope streets, four weeks previous to his death. Was at church March 20, and died at 12 M. the next day. Three men living in this house worked on the steamboat landing. The premises were crowded, thirty persons in eight rooms, and were in filthy condition, as was the neighborhood.

The physician attending, attributed the illness to the damp and bad condition of Patterson's lodging room, and to the improper and unhealthful quality of his food.

Case No. 24. — J. Baptiste, male, black, twenty-six years, laborer, died of cholera, April 2, at the corner of Marengo and Tchoupitoulas streets.

The usual occupation of Baptiste was wheeling coal, but he had been at work at the salt warehouse, near Jackson Street, two or three days before his last illness. Had lived *eight* months in the neighborhood where his death occurred.

Premises in good order. No other case in the vicinity.

Case No. 25. — B. Johnson, male, black, aged twenty years, died of cholera morbus at the Hotel Dieu, April 1. Was admitted from the St. Louis steamboat *Continental* in a dying condition. The *Continental* arrived at the levee March 31.

Of these first twenty-five cases, the white numbered eleven (11); colored, fourteen (14).

The population of New Orleans is estimated at 200,000, of which one-fourth belongs to the African race, or is of mingled blood, so that if the races had been equally affected, the proportion should have been, say six colored to eighteen whites.

The mortality, throughout the prevalence of cholera, was at the rate of ten blacks to thirteen whites.

The negro race, as is well known, suffer more severely from cholera than the white races.

The multiple cases of cholera in same domicile record are: —

No. 5, Margaret Woods, No. 10, Isabella Woods,	535 Good Children Street.	March 2. March 8.
No. 17, William Brady, No. 18, William Johnson,	S. B. Sabine.	March 30. March 31.
No. 19, Sarah Jackson, No. 20, Henrietta Jackson,	146 Chartres Street.	March 31. April 1.
No. 34, Joseph Stratmeyer, No. 46, Mrs. Stratmeyer,	Gentilly Road.	April 12. April 15.
No. 49, Francisco, No. 55, Francisco, No. 56, Antonio,	238 Julia Street.	April 16. April 17. April 18.
No. 64, Collin, No. 68, Allain,	10 Dumaine Street.	April 22. April 24.

No. 75, O'Brien, Julia No. 79, O'Brien, John	308 Magazine Street.	April 26.
No. 158, Mr. Bire (recovered), No. 156, Lizzie Bire (died),	corner Julia and Delta streets.	May 14.
No. 191, Colored woman, No. 226, Joseph Dolun, No. 253, Charles Ploff,	Insane Asylum.	May 20. May 28. June 21.

Nos. 34 and 36 lived on the Gentilly Road, two miles from the built-up portion of the city. The ridge is a narrow strip of land, slightly elevated above the swamp, extending for several miles through the continuous marsh surrounding New Orleans.

Nos. 49, 55, and 56, were relations. A member of the family being asked if he knew of any local cause for the sickness, stated that the premises were clean and in excellent sanitary condition, closing with the casual remark, as of something of no importance, that the *privy overflowed the yard* every time it rained.

In the last series at the Asylum, no evidence of interdependence could be traced.

The total number of cholera deaths, in the first six months of 1873, is two hundred and forty-four (244).

During the same period, the cholera infantum deaths amounted to eighty-five.

As the average cholera infantum death-rate for the first six months of five successive years is about forty (40), it is probably just to attribute the increase of mortality this year to cholera sporadica, and estimate the total mortality by this last mentioned disease, at about three hundred (300).

The disease occurred in nearly all parts of the city ; yet, as usual in cholera epidemics, those living in the densely populated and unclean parts of the city suffered most.

No suspicion of the existence of cholera in New Orleans having been aroused, and it not being unusual for fatal cases of congestive intermittent to be furnished with certificates of death by cholera, or cholera morbus, the first six cases were not called to the attention of the Board.

The seventh occurred at the Charity Hospital, and official notice was given of its existence. The history of antecedent cases was therefore immediately looked up, and every subsequent case visited without delay, and its history carefully ascertained.

Some discussion having arisen since that time, as to the question of importation, the ground has again been carefully gone over, and the particulars of the cases, whose history has been furnished, when practicable, minutely ascertained.

These inquiries, as previously stated, embraced all modes of infection and importation, as by visiting ships, the washing of clothing for persons connected with shipping, visiting of sailor boarding-houses, contamination of drinking water, etc., etc. This remark applies, not only to the twenty-five cases, whose history is given in full, but to every case recorded.

Examination of the records of the arrival of vessels, demonstrates that

from October 1, 1872, to June 1, 1873, no vessel came to New Orleans from Odessa, or any point on either the Baltic or Black seas, and that the only arrivals with passengers from European ports, from January 1, 1873, to May 1, 1873, were from Liverpool and Newport, England; Hamburg, Bremen, Palermo, and Marseilles.

All sick emigrants in charge of the Emigration Bureau are sent to pay wards of Charity Hospital for treatment. Foreign sailors are sent to this institution, and to the Hotel Dieu. No case of cholera occurred among emigrants. Two seamen of the English ship *Belgravia* were attacked with cholera, the one April 14, and recovered; the other, April 16 and died the 17th.

The *Belgravia* left England January 29, passed Quarantine April 4. Her crew had therefore been ten days in New Orleans, and seventy-five days out from Liverpool before the appearance of the disease. Thirty-seven cases of cholera had occurred in New Orleans previous to the sickness of these seamen.

These are the only two cases of cholera that occurred among, or near to the shipping, or that had any connection with it.

Referring to the question of the introduction of cholera from foreign ports into New Orleans, Dr. Howe, resident physician at the Quarantine Station, Mississippi River, makes the following statement: —

OFFICE OF QUARANTINE PHYSICIAN,
MISSISSIPPI RIVER, *July* 21, 1873.

C. B. WHITE, M. D., *Pres't Board of Health, New Orleans, La.:* —

DEAR Sir, — Yours of July 18, making inquiry as to whether or not any vessel had passed the Station since January 1, 1873, on which there existed cholera, or upon which cholera had existed during the voyage and prior to arrival here, is just at hand.

Since January 1, 1873, there have passed and been personally examined, six hundred and thirty-eight vessels of all kinds, and in no instance has there been cholera in any form. Nor has there been, as far as I could ascertain, any cholera during the passage of any vessel to this port. My information has been, in every instance, obtained from the master of the vessel, as well as from the medical officer when there was one on board. In some instances, when vessels have arrived from ports where cholera was supposed to exist, I have required a sworn statement from the master, signed by himself, which are kept on file as additional evidence. And in no instance have I had reason to doubt the truth of any statement or sworn affidavit.

Attached and forming a portion of this Report will be found an official list of infected vessels arriving here since January 1, 1873, as well as of vessels detained in quarantine, with full particulars concerning cause of detention, number of sick removed, with disease and result.

Any further information will be given with pleasure, while I remain,

Very respectfully,

GEORGE HOWE, M. D.,

Resident Physician, Quarantine Station, Mississippi River.

As but eight cases of cholera occurred in the last six months of 1873, and but four of these in July, the meteorology of only the first six months of the year, has interest in this connection.

METEOROLOGICAL CONDITIONS OF THE FIRST SIX MONTHS OF 1873.

The first deaths of cholera or cholera morbus, occurred February 9 and 10.

On the 7th the range of temperature was 24.5° F.; on the 10th, 19.51° F. It will be recollected that Surgeon Vickery, in his account of the second case, thought the unusual depression of temperature had much to do with its fatal result.

The third death of cholera occurred February 28. On the 24th, 25th, and 26th, the ranges of temperature were respectively 18°, 19°, and 17°.

During the first ten days of March, nine (9) deaths occurred, accompanied by very considerable daily oscillations of temperature, the mercury ranging on one day 18°, on another 20°, and on two days 20.5°.

The months of March and April throughout, present remarkable daily ranges of temperature.

It seemed pretty evident that in many cases, the exciting cause of the attack was sudden and considerable change of temperature.

I append a table showing greatest and least range of temperature for each week of the six months, and mean range for the same months: —

Abstract showing Variations of Temperature in New Orleans during the Six Months ending June 30, 1873.

Month.	Daily Range ° F.			No. of Days over 20° F.	No. of Days over 14° F.	No. of Days over 8° F.
	Highest.	Lowest.	Mean.			
January . .	23.5	5.0	12.76	2 days.	10 days.	27 days.
February . .	24.5	7.5	15.59	3 "	15 "	27 "
March . . .	37.0	7.5	16.17	7 "	19 "	29 "
April . . .	30.5	6.0	16.06	5 "	20 "	27 "
May . . .	21.0	9.0	14.29	1 "	14 "	31 "
June . . .	20.0	5.5	13.38	0 "	7 "	28 "
			14.66	18 days.	85 days.	169 days.

April and May are the diarrhœa months of New Orleans. The attacks are seldom severe, and in most cases, yield immediately to a very moderate dose of some mercurial with or without opiates or astringents.

This, too, is the cholera infantum period of the year in New Orleans. Our small mortality from that disease, occurs almost entirely in the first half of the year.

The comparative exemption of New Orleans is probably in a considerable degree attributable to the evenness of our summer temperature.

The summer thermal lines given in the last report of the Board of Health of New Orleans, afford an interesting comparison with those of the Board of Health of New York, for the same period.

In calling attention to rain-fall, as exhibited in the chart further on in the report, it is to be remembered that in 1873, April and May, meteorologically seemed to have changed places. April is usually a showery month, and May almost unvaryingly pleasant — literally a month of sunshine.

The chart shows April, of 1873, very dry, and May a month of heavy and repeated rain-falls. In New Orleans, one half inch of rain-fall is only an ordinary shower, whose effect immediately disappears, unless it has been preceded by others.

With the high, cool, and dry winds prevailing, the whole city, during the month of April, was enveloped in clouds of dust.

Several days entirely without fall of rain preceded the appearance of the first cases of cholera in February, and again preceded the first cases in March.

There is a general coincidence between the occurrence of cholera cases and the lack of rain-fall, which is more noticeable by the table of cases than on the chart, as lines of the latter are drawn to show deaths by weeks.

New Orleans should be free from contagion of drinking water by cholera poison, as usually caused, because of its water supply.

The larger portion of its inhabitants drink rain-water, from cisterns, which are invariably above ground. The remainder drink hydrant water, from the Mississippi. Water from wells is never used for cooking or drinking.

The clouds of dust alluded to might be considered as affording a means of conveyance of poison germs to the food and water of the people, and would certainly give them abundant access to the lungs, if that be considered a mode of entrance for them.

By those who think that no evidence exists of the presence in New Orleans of the peculiar poison of Asiatic cholera, this meteorological condition, and its result of continuous foul dust and exhalations, are considered ample cause for the prevalence of the disease under discussion.

The street cleaning of New Orleans consists mainly in scraping the decaying animal and vegetable matter from the gutters, and throwing it up into piles, or scattering it upon the streets.

Theoretically, this filth is moved every day; practically, occasionally.

These matters, left upon the streets, are pulverized by passing vehicles and animals, and in the dry and windy weather are lifted into the air, penetrate all dwellings, and reach the food, drink, and lungs of the people.

The dust of our ordinary earth streets contains fifteen per cent. of animal and vegetable matter. What the contents of our gutters are, their possible capacity of elimination of noxious gases, when undisturbed and uncleaned by frequent summer rains, the following extract from the late Report of Dr. A. W. Perry, chemist to the Board of Health, will show: —

"A gutter the length of one square — say three hundred (300) feet, three (3) inches deep, and fifteen (15) inches wide, contains about six thousand (6,000) pounds of semi-fluid mud, of which twenty-three (23) per cent. is solid matter. This, by the figures of the above analysis, contains sixty-three (63) pounds of animal matter, and four hundred and twenty (420) pounds of vegetable matter.

"Four different samples of foul mud (gutters) were examined, with the following results:" —

No.	Dry Residue Weight per cent.	Per cent. of Animal Matter.	Per cent. of Vegetable Matter.	Amount contained in the Two Gutters along one Block.	
				Animal Matter, pounds.	Vegetable Matter, pounds.
1	23	4.50	29.50	126.00	412
2	23	3.80	30.20	106.40	422
3	23	1.81	26.20	59.60	366
4	23	1.38	26.60	36.60	372

SUB-SOIL WATER.

The universal opinion in New Orleans has been that the varying distance of its sub-soil water from the surface, was entirely dependent on the height of the river.

Daily observations, continued throughout the year 1873, corroborate those of former years, showing that the oscillations of the ground water are independent of the rise or fall of the river, and are coincident with the presence or absence of rain-fall. They are not believed to have causative connection with the rise, prevalence, or decline of cholera, but have an interest as being a coincidence of the rain-fall, which seemed to exercise control over the cause of disorder.

There seems to be good reason to accept the rain-fall of May, as largely efficacious in checking the progress of the disease, and the continuous rains thereafter, as having removed its cause, or at least, as having been coincident with that removal.

The rain-fall of May 5, was eight (8) inches. The total rain-fall of the month, 21.87 inches.

Statements have been made that New Orleans owed its comparative exemption from cholera, — first, to its having been put into a thorough state of cleanliness and disinfection previous to its appearance; and, second, to the energetic "*stamping-out*" (so-called) measures employed by the Board of Health.

The Board of Health is accustomed to begin an inspection of all premises of the city, in the early days of January, proposing to have all vaults emptied, all yards cleaned, etc., by May 1 to 15, and thereafter to maintain such repeated re-inspections of those portions of the city in the worst sanitary condition, as is practicable.

This work of inspection and re-inspection is done by members of the metropolitan police force, detailed to duty with the Board of Health and under its orders. The police force being a part of the State militia, is liable to be recalled in periods of public emergency. Such emergency occurred

at the close of 1872, and continued into 1873, and in consequence of the withdrawal of the force, this house-to-house inspection, and general yearly cleansing, was not commenced till the last of March. It is the opinion of the Board of Health, that had its sanitary operations not been thus interfered with, cholera might have been much less general, and less fatal.

Therefore the statement that a remarkably favorable sanitary condition of the city existed antecedent to the date of the appearance of cholera, is incorrect.

After the disease was recognized as having a striking likeness to epidemic cholera, disinfection was practiced in all cases coming to the cognizance of the Board of Health. A circular, through the public journals, was issued to the citizens, giving instruction on disinfection, and many physicians took all precautions against the disease, by the usual modes of disinfection of excreta, etc. Others took no precaution whatever; therefore, in these and those other hundreds of cases where no physician was called, and no precautions practiced, there existed sources of infection ample to have poisoned the whole community and created a general epidemic.

AN ACCOUNT OF THE EPIDEMIC OF CHOLERA, DURING THE SUMMER OF 1873, IN EIGHTEEN COUNTIES OF THE STATE OF KENTUCKY.

By ELY McCLELLAN, M. D.,

Assistant Surgeon U. S. Army.

THE short time that has elapsed since the subsidence of this epidemic, the broad field over which the disease was diffused, the utter impossibility of attempting in the limited time at my command, a personal inspection of all the infected points ; the fact, that at many localities no notes or record of cases was kept, compels me to present a somewhat crude and imperfect statement of the manifestation of the disease in the State. Knowing full well that " this is no dinner to ask a man to," we present this report, with the hope that it may pave the way to fuller and more elaborate reports of future epidemics.

The history of this epidemic, as we have been able to collect it, affords strong evidence in support of well-accepted theories.

1. The portability of the cholera poison.

2. The method of propagation.

In the narrative which is presented, it will be seen that the disease entered the State of Kentucky by three distinct lines of advance, upon which the original cases have been traced.

1. By navigation on the Ohio river.

2. By travel on the Louisville and Nashville railroad.

3. By a solitary traveller over a mountain highway.

It will be shown by the narrative that the arrival of cholera in the State of Kentucky can be located on exact dates.

May 18, a steamboat from New Orleans, upon which several cases of cholera had occurred, arrived at Paducah.

June 3, a man from Gallatin, Tenn., a point infected with cholera, was taken with the disease at Bowling Green, Ky.

June 5, a negro woman, who had visited Gallatin, was attacked with cholera at Franklin, Ky.

June 8, a white man, from Evansville, Ind. (an infected point), was attacked with cholera in the city of Louisville.

June 10, a second case of cholera occurred in Franklin, imported from Gallatin.

June 12, a third case of cholera, from Gallatin, occurred at Franklin.

June 13, a negro woman, at Bowling Green, who had washed the clothing of a man who died of cholera on a steamboat from Evansville, Ind., was attacked with the same disease.

From these cases, cholera became epidemic in the counties of McCracken,

Warren, and Simpson, and spread to adjoining counties. That the disease did not become epidemic in the city of Louisville is undoubtedly due to the advantageous location of that city, and the vigilance of her health officers. The steamboat which had infected Paducah proceeded on its trip up the Ohio river, making all its usual landings, to Cincinnati, Ohio, and was followed by other infected boats.

June 29, a case of cholera is reported at Maysville, Mason County. The subject of this manifestation of the disease had returned the previous day from a visit to Cincinnati.

Until July 8, the disease was confined to the counties in which its appearance has been noted, but on this date cases are reported at Elizabethtown, Hardin County, and at Lagrange, Oldham County. At the first named point, on the 4th day of July, a celebration had been held among the negroes, which a number of persons from Bowling Green, and other infected points, are known to have attended. The origin of the disease at Lagrange cannot be determined; but as this town is located upon a main line of railway, and as the location is favorable for the development of the disease, the inference that cholera was carried to that town is quite as plausible as that it had a local malarial origin.

July 10, cholera appeared in the town of Millersburg, Bourbon County, and the remarks already made respecting Lagrange are equally applicable to this locality.

No new territory was invaded until July 17, when a negro from an infected locality in Tennessee carried cholera to the line of the work of the Cumberland and Ohio railroad, in Taylor County, and on the 19th the disease crossed the Marion County line.

To the counties already noted the disease was confined until August 10, when a white man, who had travelled on horseback from Russellville, Tenn. (an infected point), arrived at Lancaster, Garrard County, where he was taken with cholera.

August 20, a young man who had contracted the disease in Marion County died at his home in Nelson County.

August 22 a negro man, from Maysville, was taken with cholera at Millersburg, Bourbon County, at which town, on the 28th, a second epidemic was developed.

August 29, refugees from Lancaster infected with cholera the town of Stanford, Lincoln County.

August 30, the disease, which in Marion County had made but a feeble demonstration, suddenly attacked the town of Lebanon, and was carried to Adair, Clinton, Russell, Washington, Boyle, and Mercer Counties.

Reports from other counties which were infected have been so much delayed, that their present use is impossible.

McCracken County. — The reports of the epidemic of cholera as it occurred in the city of Paducah are meagre, from the fact that no record was kept of the cases which occurred. It is estimated that one hundred and eighty cases died of cholera from May 23 until July 24. About two thirds of this number were negroes. The majority of the remainder were foreigners. But few of the Americans were attacked.

The first case that occurred at Paducah, was on the 21st of May, in the person of the shipping clerk of a tobacco warehouse, who had upon the evening of the 18th inst. visited a New Orleans steamer, just arrived from Memphis, upon which several cases of cholera had occurred. He remained on board the boat during the time she was at the wharf boat, a period of about two hours. The next day he complained of malaise and some diarrhœa; upon the 20th these symptoms continued, and at an early hour of the 21st cholera was developed, and the case progressed rapidly to a fatal termination.

May 23, a gentleman who had been assiduous in his attention the previous day to the cholera case, was himself attacked, but recovered. Three cases of cholera, none of which terminated fatally, occurred among negroes who were employed on the wharf boat, at which the infected steamer lay. With these cases the disease disappeared, until a fresh importation occurred on the 3d of June, when a female, that day arrived from Memphis, Tenn., was taken with cholera, and died after a few hours' illness; the female who nursed her was the next attacked, and from these two cases the epidemic was established, and continued in existence until July 24.

No cases occurred in the hotels, jail, or poor-house.

It is a noticeable fact, that after the 25th of June, the day on which the sale of vegetables was prohibited in the town, the mortality among the negroes began to diminish. This, however, did not apply to the German population, who, regardless of the prohibition, procured vegetables in the country, and it became a recognized fact that on each Monday a large number of this class of the community were buried.

Warren County. — Bowling Green, the county seat of Warren County, is a well located inland city, situated nearly in the centre of the county, upon the line of the Louisville and Nashville railroad, and one mile from the head of navigation on the Big Barren river. Railroad communication with Louisville, Memphis, and Nashville, is almost hourly. Twice a week a steamboat arrives from Evansville, Ind.

The data of the epidemic of cholera in Bowling Green and in Warren County are very unsatisfactory, from the fact that none of the physicians had preserved records of their cases. The burial permits of the county clerk, however, furnished trustworthy information as to many cases.

June 3, the first case of cholera occurred in the person of a white man forty-three years of age, who left Gallatin, Tenn., at the time cholera was epidemic at that point, on a business visit to the horse-cave-station, some few miles north of Bowling Green. He was taken ill on his arrival at the horse-cave-station, and took the next train, endeavoring to reach his home. By the time the train reached Bowling Green, the disease was fully developed. He was taken to a hotel, where after a lingering illness he died.

June 13, the second case occurred in the person of a negro woman, fifty-five years old, who had the day before washed the clothing of a man who died on a steamboat during its trip from Evansville. She died after an illness of thirty-six hours.

June 14, a case occurred in the person of a negro girl six years of age, living near to the hotel in town.

June 19, two negro women were taken with cholera and died. They lived near to the steamboat landing.

From this date, the disease became epidemic. We have recovered the facts concerning eighty-six cases of cholera which occurred in Bowling Green between June 19 and August 10; of these cases, sixty-five terminated fatally.

The disease was confined almost exclusively to the line of the railroad, and to the low ground towards the river. The main portion of the town, on high ground, was not invaded.

The only facts we have been able to obtain, as to the epidemic in the county, are found at a point some ten miles to the southeast of Bowling Green, to which place a refugee negro carried the disease. Six members of a white family were fatally attacked.

SIMPSON COUNTY. — Franklin, the county seat of Simpson County, is situated on the line of the Louisville and Nashville railroad, six and a half miles from the State line. One mile east of the town flows the West Fork of Drake's Creek. The town is well drained by two ravines which pass through it, one to the east, the other to the west of the Court House, which building forms the centre of the town. These two drains come together north of the town and empty into Drake's Creek.

The inhabitants of this town have constant communication with all points on the railroad, and a large number of the "section hands" between Franklin and Millersburg, Tenn., reside in the town. During the month of May, the town was placed in a good sanitary condition, and much debris was removed and destroyed. No cases of serious illness occurred until the 5th day of June, when a negro woman forty years of age, who had been on a visit to Gallatin, Tenn., was taken with cholera, from which she recovered. The occurrence of this case, although the subject lived in a negro settlement, was followed by no further development of the disease.

June 10, a white man, thirty-eight years of age, who had returned from a visit to Gallatin, Tenn., was attacked with cholera and recovered.

June 12, a white man, fifty-one years old, also from Gallatin, was taken with cholera, lingered ten days and died.

June 13, the physician who attended the case of the 12th was taken with the disease, but recovered.

June 14, the daughter, aged two years, of this physician, was attacked and died in nine hours.

Four days elapsed without the development of new cases, when a white man, forty years of age, was attacked and died. June 20, a white woman recovered. June 25, a white man died. June 27, two new cases, both died. June 28, two new cases, both died.

The disease was in abeyance until July 1, when seven deaths occurred, and in the next fifteen days, fifty deaths are reported as resulting from the epidemic. On July 20, a fatal case occurred, and cases occurred with a like termination on July 28 and August 4.

Thirty cases of developed cholera are reported as having recovered during the epidemic. Seven of the physicians of the town were seriously

ill; one of them died; one case occurred in the county jail, none in the hotels or poor-house.

A gentleman left Franklin July 1, went six miles east of town, where he died after forty-eight hours' illness; in three or four days his mother-in-law was attacked and died; a visitor at the house and a young child also died. All the other members of the family suffered with diarrhœa.

A lady, after nursing many cholera cases in Franklin, went four miles west of town, to the house of her son-in-law, who had not been exposed to the infection, before her visit; he was taken with the disease and died. All the other members of the family suffered with diarrhœa and vomiting. The wife of the county jailer was taken with cholera and died in a few hours. The prisoners were at once removed from the building.

JEFFERSON COUNTY. — The first case of cholera which is recorded as having occurred in Jefferson County during the past epidemic, was in the city of Louisville on the 8th day of June, when a white man twenty-nine years of age was admitted to the Louisville City Hospital with cholera. He had arrived in the city at five A. M. from Evansville, Ind., where cholera was epidemic; shortly after his arrival, he was taken with purging and vomiting, which increased so rapidly in its severity that he was obliged to lie down on the sidewalk. From this position he was removed to the hospital, where he died at half-past four P. M. of the same day.

June 10, a gentleman, forty years of age, living on Walnut Street, between Seventh and Eighth Streets, was attacked with cholera, following a diarrhœa of a few days' duration. The disease was arrested and the patient recovered.

June 12, a conductor on the Louisville and Nashville railroad, who had been taken ill in the city of Nashville, Tenn., arrived at his home in Louisville. The disease was violently developed and the case terminated fatally in a few hours.

From June 12 to August 16, inclusive, twenty-one cases of cholera, all of which terminated fatally, are reported as occurring in Louisville. Many of these cases were imported from other infected localities.

August 9, Dr. J. T. Atchison, of Lacona, nine miles southwest from Louisville, reports a case which recovered.

August 18, Dr. S. A. Foss, of Lacona, reports the occurrence of two fatal cases.

September 4, a group of cases was reported by Dr. Turner Anderson, as occurring in Louisville. The house in which these cases occurred is situated in the western portion of the city of Louisville. It is a frame cottage, low and damp. The kitchen floor is several inches below the surrounding ground. No provision was made for drainage. The privy, wash-house, and coal-shed, all under one roof, and all in a dirty condition. The family occupying this house consisted of the mother, two single daughters, two married daughters, one son-in-law, and two young children, a total of eight individuals. July 30, a married daughter (Mrs. G.) was taken with vomiting, purging, and cramps. The attack was sudden, and no cause could be assigned. She was, however, speedily relieved and soon convalesced. This lady, two weeks prior to her illness, had been delivered of a healthy child.

August 22, Mrs. G. left Louisville to visit her husband in the city of Bowling Green. August 25, she was attacked with cholera in that city, and died after twelve hours' illness. August 28, the remains of Mrs. G., inclosed in a wooden coffin, arrived at her mother's house in Louisville. Prior to burial the coffin was opened, and the remains viewed by her family.

September 2, a child of the late Mrs. G., two years of age, was attacked with cholera, but recovered.

September 4, a single sister of Mrs. G., residing in the house from which the corpse had been buried, was attacked with cholera, and died after an illness of six hours. The same day, the infant child of the late Mrs. G., four weeks old, was attacked with the same disease and died in forty-eight hours.

September 6, the second married daughter in the same house was taken with cholera after a slight premonitory diarrhœa; died in twenty-four hours. After the remains of Mrs. G. had been brought to Louisville, all the members of this family took quinine in decided doses, except Mrs. A., who declined to do so, from the fact that she was seven months pregnant. No other member of this family was attacked.

September 8, Dr. J. P. Warren, of Marion County, died of cholera in Louisville, after twenty-four hours' illness. This gentleman had been subjected to the infection in Lebanon. September 11, a recovery of a cholera patient is reported.

That the city of Louisville escaped an epidemic of cholera is undoubtedly due to the admirable sanitary condition in which the city was maintained, and the careful system of disinfection which was instituted wherever the disease appeared.

Mason County. — The city of Maysville, located on the Ohio river, had suffered greatly in all the epidemics of cholera that had visited the valley of the Ohio. In 1849, the disease had remained in force from April until November. There seemed to be just grounds for apprehending a serious epidemic in 1873. From the present epidemic this city, however, almost entirely escaped. From June 29 to July 25, but fourteen cases occurred, eight of which terminated fatally. Of these, seven occurred in one negro family.

June 29th, a young man, just returned from Cincinnati, Ohio, was attacked with cholera and recovered.

June 30, a lady resident of the city was attacked with cholera, and recovered.

July 3, Dr. Shackelford, reported the first of a most interesting group of cases, in the person of a negro woman, who died after an illness of fifty-two hours. July 5, the daughter, aged twenty years, was attacked with cholera, and died after ten hours. The same night, the young child of the second case was taken ill and died. The next day, July 6, after the funeral of the second and third cases, the house was abandoned, but in a few hours the husband and two sisters of the second case were attacked. These cases were treated at the city hospital; the man and one of the women died. July 7, a negro woman who had been in attendance upon the first two cases,

was taken with cholera and died the next day. This family of negroes had resided in a small cabin on a hill-side. The ground around was extremely filthy, and the drainage and surface washings of this filthy yard was into the well from which the family obtained water.

From July 25 to August 18, no new cases of cholera are reported in the city; but on the last date a white female, in destitute circumstances, was brought to the city from some point on the river, and died after an illness of three days. August 25, a negro man was brought to Maysville from a point twenty-five miles above the city. He was attacked with cholera before his arrival. The disease did not advance beyond the second stage, when it was arrested.

September 1, a negro man was brought to Maysville by boat, and although then in the stage of collapse, was placed in a spring wagon and carried to Millersburg, where he died. These three instances of the importation of cholera, produced no epidemic in the city. Dr. J. M. Duke, who has witnessed every epidemic since 1832, attributes the exemption of the city from the disease to the almost universal substitution of cistern for well water.

Hardin County. — Elizabethtown, the county town of Hardin County, is located on the line of the Louisville and Nashville railroad, having a population of 1,743, of whom 660 are negroes.

This town is in almost hourly communication with Bowling Green, Paducah, and Louisville. The site is drained by a small creek which flows in a southwest direction, between the town and the line of the railroad. On the bank of this creek, and leading from Main Street towards the northeast, is a small street known as "Race Alley." The ground upon which it is located slopes to the creek, and both sides of the alley are lined with negro hovels. During the month of June the roadway had been filled up several inches above the line of the surrounding ground, and the drainage thus obstructed, the ground under the hovels on the western side of the alley was flooded from the higher ground upon which the main portions of the town is situated.

July 4, a negro celebration was held at Elizabethtown, which a large number of negroes from along the line of the railroad and the adjacent country attended.

July 8, a case of cholera occurred in the person of a negro man, who, although not residing on Race Alley, was in constant communication with that locality. His illness lasted twelve hours and terminated fatally.

The second case occurred on Race Alley, July 10, and died within twelve hours, and from that date until September 24, the disease was epidemic. Forty-one cases of cholera occurred, twenty-two of whom died. The disease was mostly confined to Race Alley; one or two cases occurred in the town late in the epidemic. Of one family, five members were taken sick, with one death. In another family three persons were attacked; all died.

On the 26th of August, a farming community, six miles southeast of Elizabethtown, was infected by a refugee from the town. Four cases occurred in rapid succession; all died. During the epidemic, a young man from the town visited a friend some three miles from the infected district.

This friend had studiously avoided any contact with the infection. They slept together one night; the next day the countryman sickened and died in a few hours from cholera.

No public buildings were invaded by the disease.

At the time of closing this report, no other records of cholera have been received from Hardin county. The town of West Point, at the mouth of the Rolling Fork, was invaded by the disease. Some fifty or sixty deaths occurred, but the necessary data of their classification has not yet been received.

OLDHAM COUNTY. — La Grange, Oldham County, is situated on the line of the Louisville, Cincinnati, and Lexington railroad, twenty-seven miles from Louisville. The town is built on a well drained ridge, at the lower portions of which are located the cabins of the poorer classes of negroes. The inhabitants are in constant communication with Cincinnati, Lexington, and Louisville, by passing trains. The sanitary condition of the town was bad in the months of June and July. The privies are on the surface, and cleaned by surface washings. Well water is almost exclusively used, and the portion of the town which suffered most severely from the epidemic is so situated, that after rain-falls the wells of the locality would most likely be contaminated from the higher ground. From the 8th to the 29th of July, cholera was epidemic in La Grange. Thirty-one cases are reported, fifteen of which died, sixteen recovered. A few cases that resided in the country became infected in the town.

BOURBON COUNTY. — In this county the epidemic was confined to the town of Millersburg, which is located on the line of the Maysville railroad, and upon the banks of Hinkston's Creek. This creek flows around the town from the northeast to the southwest; a mill-dam upon this creek backs the water for a considerable distance, and the accumulation on the bottom, above the dam, has greatly lessened its depth. During the past summer the rain-fall was small, the water was low in the creek, the mill-pond was stagnant, and an extensive surface covered with decomposing vegetable matter was exposed. On the eastward, high ground separates the creek from the town.

Northeast of the town, at the head of a deep hollow, and on high ground which gradually descends to the level of the creek, is a large artificial pond, the drain of which follows the eastern limits of the town and empties into the creek. This drain runs parallel with and finally crosses the Maysville railroad. Immediately below this pond, the ground is marshy from the soaking of water through the embankment of the pond, and in this wet ground, a number of sunken barrels furnish the water supply for a cluster of cabins occupied by negroes, who live along the sides of this drain. Two other ponds of stagnant water are on the eastern side of the town.

On the 11th day of July, during very hot weather, six cases of cholera occurred in the immediate vicinity of the large pond, and in the cabins on its outlet drain; and within thirty-six hours all had terminated fatally.

July 12, two cases occurred; one near the pond, the other upon the banks of the mill-pond south of town. The last case had spent a portion of the previous day in the houses in which the disease originated.

This development of cholera is attributed to malarial influences, and the instances narrated are held as strongly illustrative of that theory. It is, however, certain, that prior to this outbreak, cholera had become epidemic at points within railroad communication with Millersburg.

No other cases of cholera occurred in this town until August 22, when a negro man from Maysville was attacked, and died after an illness of four days.

August 28, eight cases of cholera occurred in the town, but two of which recovered.

August 29, eight cases occurred, and all terminated fatally in a few hours.

From August 30 to September 7, the disease was epidemic; seventy cases occurred in this town, forty-nine of which died. It is known that other cases occurred, but as no record was made of them, it has been found as yet impossible to locate them with any exactness.

These cases all occurred on low ground, in the vicinity of the pond drain, and upon the banks of the creek.

Five cases of cholera were brought to the town of Paris, and Dr. Keller reports that although no precautions were taken, the disease did not spread. Dr. Keller reports most favorably of the efficacy of large doses of calomel in the treatment of cholera. He found that exhibited in two-drachm doses, it invariably relieved the vomiting and purging, and arrested the disease. This treatment was applied to the majority of the cases which recovered, and in none was ptyalism induced.

TAYLOR COUNTY. — The history of the epidemic of cholera in Taylor County is interesting from the fact, that in this county, undoubtedly, is to be found the first link in the chain of infection which stretched to most of the counties of Central Kentucky.

Early in the month of July, a negro man, who had left an infected locality in the State of Tennessee, applied for work in one of the construction parties of the Ohio and Cumberland railroad. He obtained work on the tunnel section, and was given quarters in a group of cabins occupied by other workmen and their families. A few days after his arrival he was attacked with an acute diarrhœa, from which he was confined to his bed for eight or ten days. The attack was attended with great prostration and general constitutional disturbance. His excreta were thrown out on the ground. The cluster of cabins were located upon a hill-side. Immediately below and in front of them, was a spring from which the families of the neighborhood obtained water. On the 14th, 15th, and 16th of July, there was considerable rain-fall and the surface washings filled the spring to overflowing.

July 17, two violent cases of cholera occurred in the cabins immediately adjoining the one in which the diarrhœal patient was living. Both cases terminated fatally within eleven hours. One was in the person of a negro woman who was eight months pregnant. Labor pains came on during the second stage of the cholera attack, and she was delivered of a dead child while completely collapsed.

July 20, a negro man on the same works was taken with cholera; the

disease was fully developed. He, however, reacted, and made a slow recovery. The same day, a negro man, eighteen years of age, who had been in constant communication with the negroes on the railroad works, was attacked with cholera in the town of Campbellsville, from which he died after forty-eight hours' illness.

August 1, a negro woman, fifty years of age, living on the line of the railroad works, some three miles from Campbellsville, was taken with cholera and died after nine hours' illness.

August 2, a white man, sixty-three years old, living on the same line of works, and five miles from the town, was attacked and died in forty-eight hours. In the same house three cases of choleraic diarrhœa occurred immediately after this death; all yielded to treatment.

August 5, in the same neighborhood, a negro girl, eighteen years of age, died after an illness of twenty-four hours. Dr. Hodgen, a most trustworthy observer, reports the occurrence of eighteen cases of acute diarrhœa, along the railroad works, and north of Campbellsville.

August 16, a white man, thirty years of age, a stage driver between Lebanon and Columbia, was taken with symptoms closely resembling cholera; in a few hours reaction was established, convalescence ensued, but committing some imprudence, a relapse took place, and he died. This death occurred in the Campbellsville hotel.

August 19, a recovery from cholera is reported at the tunnel section of railroad.

August 21, a negro man, thirty years of age, who had left his home in Lancaster on account of the cholera, was taken with the disease in the town of Campbellsville, and died in seven hours.

September 2, a white boy, sixteen years of age, who was in Lebanon for two days of the epidemic in that town, but who had returned to Campbellsville, was taken with cholera, but recovered. The same day a Mr. Henry Creele, sixty-three years of age, who had left Columbia after cholera had become epidemic in that town, was attacked, and after an illness of fourteen hours, died. This death also occurred at the hotel.

September 8, a contractor on the railroad, aged twenty-five years, who had spent the two previous days in Lebanon, was taken with cholera and died within eleven hours. Many cases of acute diarrhœa occurred in the town of Campbellsville after the 8th of September, but none advanced to the stage of danger; no other cases of cholera occurred. The inhabitants of this town had declined to attend the Marion County Fair. No cholera was developed in the person of any resident of the town. The two cases at the hotel did not spread the disease. Disinfectants were actively used in all the cases that occurred in the town.

Marion County. — Lebanon, the county town of Marion County, is located on the Lebanon branch of the Louisville and Nashville railroad. Situated nearly in the centre of the county, it is not only the market town of the farming community, but is the base of supplies and shipping point of several small towns and hamlets. The railroad passes through the centre of the town from east to west upon low ground, following the course of a

small stream, which heading in a spring to the northeast, forms within the corporation limits two large ponds for the use of the railroad and a large flour mill. From these ponds the stream, to which the name of *Jordan* has been given, flows through the town in a southwest direction. Its course is protected by stone walls and the crossings of the several streets are securely covered. This stream is the receptacle of filth of all kinds; flowing in rear of the buildings on the north side of the main street, the privy of nearly every establishment is built over it.

At the southeast of the town is a small rivulet fed by impure streams and the drainage from high ground. These two streams form the natural drainage of the town.

Railroad Street is lined with dwellings. Some are comfortable, but the largest number are occupied by negroes. A flour mill is located at the head of this street. The floor of the lowest story of this mill is raised a few inches from the ground. A drain leads from below the foundations and empties into the Jordan. The effluvia from this drain attracting attention, it was found that the space below the floor was nearly filled with decomposing vegetable matter, and that from one corner of the foundation a spring of considerable volume issued. In the centre of the town is the Court house, having in front of it a public well, from which all who live in the vicinity are supplied with water.

During the months of June and July, the earnest solicitations of the physicians of Lebanon, who had formed themselves into a Sanitary Association, secured a cleansing and disinfection of the Jordan, the removal of much debris from dwellings, the disinfection of the reeking mass of decomposition under the flour mill, and a general cleansing of the streets.

July 19, a negro man employed upon a section of the Ohio and Cumberland railroad, six miles from Lebanon, was suddenly taken ill with all the symptoms of cholera, and died collapsed within eight hours from the inception of the disease. It was ascertained that he had been at the cabins of the railroad hands in Taylor County, where cholera had been developed on the 17th instant. At the time this case was termed "cholera morbus." The other laborers on the section, and those living in the shanty in which he died, had constant and daily communication with the Lebanon negroes. The excreta were not disinfected.

August 11, a negro woman, fifty-five years of age, living between the railroad and Jordan, near to the depot, was taken ill. She presented all the symptoms of cholera, and died fully collapsed in ten hours. The excreta were not disinfected, but were cast on the ground in rear of the house.

From the 11th to the 18th of August, several cases are known to have occurred among the lower classes of the negroes, having the symptoms more or less well marked. No record of these cases can be furnished, from the fact that the medical man in whose care they occurred died himself of the disease.

August 18, a white man, fifty years of age, was attacked. After a severe struggle the disease was arrested, and he made a tedious recovery. The case most admirably defined the distinctions between "serous cholera"

and "cholera asphyxia." This man lived on Railroad street, near to the depot, and close to the house in which the case of the 11th occurred. The excreta were not disinfected, but were thrown on the ground in rear of the house.

August 19, a young lady, eighteen years of age, was attacked, but the disease was arrested before the second stage was fully developed. This case also resided on Railroad Street, east of the depot. The excreta of this case were not disinfected.

It is of importance to notice that the foregoing cases were rated at the time as "cholera morbus." Each had been the subject of some imprudence, to which the violence of the symptoms were attributed; and it was only after a subsequent study of each case that its true status was determined.

On the same day, a white man, thirty-five years of age, of intemperate habits, living on the well-drained portion of the town north of the railroad, was taken with diarrhœa; in a few hours cholera was fully developed. The symptoms were terribly violent, no relief could be obtained from the most active measures, and he died in ten hours from the inception of the disease. The excreta were carefully disinfected and buried, the clothing was washed in a strong carbolic acid solution, the mattress upon which he died was burned.

August 25, a white man, forty-five years of age, temperate in his habits, living at the cemetery grounds (of which he had charge), died with fully developed characteristics of cholera, after an illness of fifteen hours; and the same day a negro man, living in the centre of the town, and directly over the Jordan, died with the same symptoms, after an illness of sixty hours, during all of which time the urine was suppressed. This negro, it was ascertained, had previous to his illness spent a day and night at the shanty in which the case of July 19 died. In neither case were the excreta disinfected.

On the 26th of August, the Marion County Fair was held on the grounds near Lebanon. Large numbers of visitors from the adjoining counties were collected. The grounds not being supplied with water, a contract was made to supply from town the deficiency. The contractor selected a well on the low ground within thirty feet of the Jordan, in the vicinity of the depot, and within a short distance of the houses in which three of the cases noted had occurred. This well had been dug in 1854, on what was formerly a drain, leading from an elevation, upon which is an old grave-yard. The well was sunk through a "shaley kind of mud-stone" and the first water that entered came in about eight feet from the surface and from the direction of the Jordan.

On the 27th, a violent rain-storm deluged the county, flooded the Jordan, and filled this well. On the 28th and 29th, the attendance on the Fair was larger than usual, and the water from this well was served as on former days.

No case of violent illness had occurred in the town since the 25th; a fatal security seemed to possess all; but during the night of the 29th, and the early hours of the 30th, the blow was struck.

It might be said, simultaneously, thirteen cases of cholera occurred, and within ten hours nine had terminated fatally. Two lingered for ten days and then died. Two made slow, tedious recoveries. At almost the same hour, four cases occurred at the St. Mary's Station; two died in eight hours; two recovered slowly. One case occurred at Raywich, distant from Lebanon nine miles, and died in sixteen hours. These persons had all attended the Marion County Fair.

In Lebanon, the disease confined itself to no locality. The high ground north of the town received the first blow. Several cases occurred near the flour mill; the others dotted the town.

During the night of the 30th and the morning of the 31st, the disease developed in the county. On all sides of the town, and in the most secluded positions, wherever those who had visited the fair ground during the 28th and 29th resided, cholera was developed. Three new cases occurred in the town; one died, two recovered. In the county eleven cases were reported, with six deaths.

September 1, one case reported in town, which recovered after an illness of three or four weeks. Thirteen cases reported in the county, with seven deaths. From September 2d to October 1st, one hundred and sixteen cases are reported as occurring in Marion County, with fifty-six deaths. It is safe to conclude that many of the cases of cholera reported as recovered, must be classed as "mucous cholera," while many were undoubtedly of the "serous" variety, demanding active and constant treatment. During the entire epidemic, a company of United States troops occupied the barracks which are situated on the north of the town. The garrison was in most admirable order; a close supervision was kept over the troops; extraordinary precautions were adopted to discover the disease in its incipient stage, should it occur. Camp regulations were maintained; duty was performed as usual; no unusual restrictions were imposed, but the vigilance was constant. One married soldier, who resided outside of the limits of the garrison, and his child, died of cholera; the child September 8, the father September 10.

In but one instance did two cases of cholera occur in one house during the epidemic in the town, with the single exception of the Guthrie House, where five cases occurred, three of which terminated fatally. Two cases only occurred on Main Street; one died, the other recovered. A hotel on Main Street, about one hundred yards from the railroad depot, was free from the disease, and no cases occurred at either the County Jail or the Alms-house.

In the majority of cases, the excreta were disinfected and buried; reports from some portions of the county state the impossibility of obtaining disinfection. Even when the disinfectants were placed in the hands of the friends of patients, they either neglected or refused to use them. The necessity of disinfection was fully recognized by all the physicians of the county with a single exception.

Nelson County. — The history of the epidemic of cholera, as it affected Nelson County, can only be obtained from the towns of New Haven and

Boston, and their immediate vicinity. These towns are upon the Lebanon Branch railroad, and are both in the hearts of thriving farming communities. Bardstown, in the northern portion of the county, was infected to some extent, but it has been found impossible as yet to obtain the records.

The first cholera case in Nelson County was in the person of a young man, residing some six miles northwest of the town of New Haven, who was seized with cholera August 20, and who died after an illness of nine hours. The patient's dejections were not disinfected, but were thrown out on the ground.

August 21, the mother and brother of the deceased were attacked with cholera, and both died within fifteen hours.

August 23, the sister of the first case, and her husband, who had been in constant attendance upon the sick in this house, were attacked, but recovered.

August 25, a lady sixty years of age, an inmate of the same house, was attacked with cholera and died after eighteen hours' illness.

August 26, the seventh case occurred in this house, but recovered. It was subsequently discovered that the young man who was first attacked, had been the previous day (August 19) in attendance upon a friend who died of cholera, in the town of Lebanon, and that he had assisted in preparing the body for burial. The residence of this group of cases *was not in a malarial region.*

September 2, a white man was taken with cholera near New Haven, and died after an illness of sixty hours. The day before he was attacked he had visited the house of a friend in Marion County, where several cases of cholera had occurred, and at the time of his visit two cases of the disease were under treatment in the house. He did not enter the house, but sat upon a back porch, on which the dinner was served. The head of this house, being fully convinced of the non-communicability of cholera, had declined to make use of disinfectants, and all the excreta of the patients had been thrown upon a heap of debris within a few feet of this porch.

These cases were followed by the occurrence of twelve others in the town of New Haven. In each case the infection was traced either to the Marion County Fair, or to the two localities, the infection of which has been noted.

The town of Boston was infected directly from Marion County. September 2, a negro woman, who had just arrived from Lebanon, was taken with cholera, and recovered after a severe illness. To September 8, six cases of cholera occurred in the same house, all of which died.

September 9, three deaths occurred in persons who had left the infected house after the disease had developed. The house in which the majority of these cases occurred was on low, wet ground, and its sanitary condition was most miserable.

Garrard County. — In Garrard County the epidemic of cholera was confined almost exclusively to the town of Lancaster, and to refugees from that town after the development of the disease. Lancaster is situated nearly in the centre of Garrard County; in 1870, it had a population of

seven hundred and forty-one inhabitants, three hundred and thirty-one of whom were negroes. Among these people, the memory of the epidemic of 1833, at which time the town was almost depopulated by the ravages of cholera, had been kept green, and this fact accounts for the terror which the occurrence of the disease in the present year produced.

The town is built upon undulating ground, the business portion occupying a high and well-drained position. On the eastern side of the town, the street known as *Richmond Street* descends abruptly to a valley, through which a small stream flows, in a northeasterly direction. This stream affords drainage for the main portion of the town; its banks are marshy and overgrown with wild-grasses and weeds. Beyond this stream the Richmond road ascends a considerable hill, upon the summit of which is located the barracks of the United States troops. The space between the barracks and the town is occupied by private residences. North of the town the streets terminate in the Lexington and Sugar Creek turnpikes; on the west in the Danville road; on the south in the Stanford and Crab Orchard roads. Upon each side of the eastern drain, and upon the low ground upon which it empties after crossing the Sugar Creek Road, large numbers of hovels are occupied by negroes, and upon its banks, outside of the town limits, is a slaughter-house, the effluvia from which, at times, pervades the entire town. In the month of August, 1873, the town was in a bad sanitary condition; no attention had been paid to its police. Filth of all kinds was scattered around the negro cabins; human excrement was entirely upon the surface of the ground. The water supply of the town is obtained chiefly from wells, and the majority of those in public use are in such position that after each rain-fall they must inevitably receive a large portion of their contents from the surface washings. One, known as the *Richmond Street well*, to which subsequent reference will be made, is situated quite upon the banks of the eastern drain. Above it, upon the slope of the hill, are stables, cow sheds, and privies, and it is notorious that after rainfalls this well has been tainted with the washings from them; and when the fact is taken into consideration that throughout the southwest, the stables and adjoining premises are invariably used as privies, the condition of the fluid contents of this well would favor the spread of disease.

On the 10th day of August, a Mr. Bewley, who had travelled from Russellville, Tenn., which town at the time of his departure was infected with cholera, arrived in Lancaster, and lodged at the house of one Tate, who resides on Richmond Street, about one square east of the Court-house. His trip had been made on horseback, and he stated that on his arrival at London, Ky., he was taken with vomiting and purging, the exhaustion from which had been so severe, that he was obliged to remain in bed for a day or two. Before he reached Lancaster he was again taken ill, and shortly after his arrival an attack of cholera was fully developed. After a severe illness of many hours' duration, reaction was established, but he passed into the condition described by Jaccoud as "typhoid cholera," and died on the twelfth day of his illness.

The excreta were not disinfected, but were thrown upon the ground in

rear of the stables and out-houses, in such position that the infection of the Richmond Street well was inevitable.

August 14, a negro man, fifty years of age, was taken with cholera fully developed, and died in twelve hours. This man had waited upon Bewley. By him the excreta were emptied, and the various vessels washed. The excreta of this case were not disinfected, but were cast upon the ground. He died in a cabin, nearly at the head of the eastern drain.

August 15, a white man, sixty years of age, the father-in-law of Bewley, who had spent a day and night in nursing him, and who had slept in the sick-room, started for his home in the country. On the road was taken violently ill, and died in eight hours.

August 16, a negro woman living upon the same street as Bewley, and within a few yards of the house in which he was ill, was taken with cholera and died in twenty-two hours.

August 17 and 18, no new cases occurred; but on the 19th five negroes, — three females and two males, — living on the same street as Bewley, were attacked, and within the next ten hours all had died. On the same day a lady, thirty-five years of age, living within the infected district, abandoned her home and started for the house of friends on the Kentucky River, a distance of some ten miles; on the road she was taken ill, and died within sixteen hours.

August 20, a negro man, twenty-five years of age, who had left his home in the infected district, was attacked at a cabin on the southwest side of town, and died in six hours. On the same day the mother of the negro woman who died on the 16th was attacked, and died in ten hours. This woman had continued to reside in the room in which her daughter died. It was subsequently ascertained that a negro woman, who also lived in this locality, but who had left home on the previous day, died at camp Nelson on the Kentucky River, after an illness of sixteen hours.

It is an ascertained fact that until this date (August 20), all who had taken the disease had not only lived in the vicinity of the Tate house, in which Bewley was ill, but they one and all obtained their water from the well on Richmond Street. Nearly all the other residents of this district suffered from vomiting and purging, more or less violent, but all yielded to treatment.

The camp of the United States troops was in most admirable order, the police was perfect, and although the infected district lay at the foot of the hill on which the Post is located, no cases of sickness had occurred. The water supply was obtained from a spring east of the camp, and so located as precluded all possibility of its becoming infected. Strenuous efforts were made to prevent the soldiers having access to the infected district. On this date the town was almost entirely deserted by all who could leave, save by a few brave men and devoted women who remained to fight the disease, comfort the sick, and subsist the destitute. It is well to note at this point, that the town authorities expended over three thousand dollars upon the sick and destitute during the epidemic. Up to this date no efforts at disinfection had been adopted; terror seemed to oppress all; but during the

evening a thorough system of disinfection was instituted. As far as it was possible, the ground already infected was cleaned. Lime, copperas, and carbolic acid, were freely used, and each householder was required to supply himself with these articles for use on his premises.

August 21, five cases of cholera occurred. One was a negro man who continued to occupy the same cabin in which his wife had died on the 19th. Two others of these cases were the wife and sister of the negro man, — the first death reported on the previous day. These women had acted as nurses to their husband and brother, had drank the water from the Richmond Street well, and had used the privy into which the dejections of the patient had been emptied. One died in the house in which the man was taken sick and died. The other removed to a cabin west of town, in which at a subsequent date other cases occurred. The five cases reported on this day all terminated fatally in ten hours.

August 22, a white man, forty-five years of age, of intemperate habits, was taken with cholera and died within ten hours. He resided at a boarding house on the hill-side, above the railroad depot. His excreta were disinfected and buried. Of the eight or ten other residents of this house, none were taken with cholera, although four or five cases of diarrhœa and vomiting occurred among them. The same day an old negro man from the infected district, was taken ill in an unfinished building and died in twenty hours.

August 23, a soldier, living in the rear of an officer's quarters, located on the high ground in front of the barracks, was suddenly taken with cholera and died in twelve hours. Early on the 24th his wife was attacked and died in eleven hours. No cause for the occurrence of these cases can be found in any imprudence on their part. The water they had used was from the spring used by the garrison, and not from the Richmond Street well, as has been stated in some reports of the epidemic. A few days previous to this sickness they had employed a negro woman from the infected district as a laundress, and it is positively stated that this was the only intercourse they had with the town.

August 25, two cases occurred. One, a lady who had nursed Mr. Bewley and had used the water of the Richmond Street well, was taken with the disease and died in ten hours. A white man was attacked the same day and recovered.

August 26, a negro man, in whose house two cases of cholera had already died, was taken with cholera and died in eight hours. And a lady, twenty-one years old, living near the town, and at whose house the case which recovered on the 25th occurred, was taken ill and died in eighteen hours.

From August 27 to September 6, sixteen new cases of cholera are reported, twelve of which terminated fatally; four recovered. Two of these cases were in the persons of soldiers who were attacked and died August 29. One of these men had nursed and assisted in preparing for burial the soldier and his wife who had died on the 23d. They both occupied the same tent and bed. Both being dissipated, reckless men, the supposition is strong that they visited during the nights, negro houses in the infected dis-

trict. The day following the death of these two soldiers, the command was moved from the barracks to a camp some two miles distant from town, where no new cases occurred.

From September 5 to September 21, no new cases occurred in Lancaster; but on the last named date an old lady, seventy-one years of age, visited the Tate family. She occupied the room in which Bewley had been sick and died, and the day after her arrival was taken with cholera and died in thirty-six hours. This case terminated the epidemic; singularly, the first and last case occurred in the same room of the same house.

During the epidemic no cases occurred in either of the hotels, the County Jail, or the Poor-house.

Lincoln County. — The epidemic of cholera in Lincoln County, so far as reports can be obtained, was exclusively in the immediate vicinity of the county town, Stanford, in which town there is a population of seven hundred and fifty-two individuals, three hundred and thirty-eight of whom are negroes. The town is situated in a valley, through which flows St. Asiph's Branch, a small stream of remarkably pure water, taking its origin in some springs about one mile from town. It has always been a healthy town, free from miasmatic diseases. Epidemics of any kind rarely visited it. North of the town, and at a considerable elevation, passes the Lebanon Branch Railroad.

Cholera, of a malignant type, made its appearance in this town on the morning of the 29th of August. That portion of the town in which the disease first occurred is known as Maxville, lying northwest of the railroad depot, and is inhabited almost exclusively by negroes. It is the most elevated portion of the town. Its sanitary condition at the time was very bad. Some efforts have been made at its police, but were ineffectual. In the rear of the houses where the disease first occurred, was a sink, some fifteen yards in diameter. On the northern edge of this sink, and a few yards from these houses, was the privy of the neighborhood. On the western edge there are two small springs of impure water, which empty into the sink, some twenty or thirty feet from the privy, which being daily used by a large number of negroes, was filled to overflowing with putrid excrementitious matter. The odor arising from this sink pervaded the entire neighborhood.

About one week previous to the appearance of cholera in Stanford, a young man died of the disease at his home about two miles from town. He had been employed in the town of Lancaster during the first week of the prevalence of the disease, but quitted his work and returned home. The special data of his case cannot be obtained, from the fact that the physician who attended him declined to notice any of the requests made to him.

During the Lancaster epidemic, many refugee negroes made their homes in Maxville; they made use of the common sink, but as far as can be learned, none were taken with the disease.

August 29, five cases of cholera occurred in Maxville. They were taken ill within a few hours, and all had terminated fatally within fourteen hours.

August 30, in the same locality five cases occurred, all of whom died within thirteen hours. The town authorities took possession of a negro church near the infected locality, a hospital was organized, which was placed under the charge of Dr. S. P. Craig, to whom we are indebted for the history of the epidemic.

August 31, in the same locality, a white woman, twenty-five years of age, and her infant, one year of age, were taken with the same disease; both died, the child in twenty-four hours, the mother in forty-eight hours.

From September 1 to September 12 nine cases of cholera occurred, six of which recovered slowly; three died. These cases were followed by some eight or ten cases which presented all premonitory symptoms of the disease, but all yielded to treatment.

September 28, a gentleman and his wife residing near to the infected district were both attacked with cholera. The case of the lady terminated fatally within twenty hours. The gentleman made a tedious recovery. This family had abandoned their home on the day cholera developed in the town, and remained in a healthy locality until ten days had elapsed from the last reported case. During this absence their house remained closed and unoccupied. After the return of the family, the precaution was adopted of bringing all water that was used in the house from a well in the town which had been used with impunity by a large number of families.

The first few days of the epidemic, the disease was confined to the locality described as Maxville and to those who fled from that district upon the development of the disease. Four cases occurred near the centre of the town; of these, two cases were in one house; the other two lived separately, but in the same locality. No cases of the disease occurred in hotels, the County Jail, or Alms-house.

Adair County. — In Adair County the epidemic of cholera was confined to the town of Columbia, to one locality of the town, and to a few cases who, having visited the infected locality, returned to their homes in the country. Columbia, the county town of Adair County, has a population of about six hundred inhabitants. Very few negroes reside within the corporation limits. The town is built upon a hill-side, and is by nature most admirably drained. The arrangement of the town is on a square, in the centre of which stands the Court-house; opposite to the Court-house, streets to the north, south, east, and west, lead off. This square is occupied by business houses, a few private dwellings, and the hotel, — the "Winfrey House," which faces the Court-house on the corner of the street leading north. On the side street and opposite to the hotel, is a large barn which is used as a livery stable. Columbia has always been considered a healthy town; the epidemics of the past were cholera in 1833 and 1835, from which diseases the inhabitants suffered severely; dysentery in the fall of 1849, from which over sixty of the inhabitants died; and camp fever in the winter of 1862, when a large number of soldiers died; from which time until the present year, no disease has become epidemic.

In the month of August of the present year, the sanitary condition of the town was bad. The privies and the stables of the town and their premises

were filthy. Human excrement was mixed with the debris around the stables. In rear of the stable of the Winfrey House was a privy pit which was full to overflowing with human excrement, and was located in such a position that the surface water drained into it. The hotel is an old brick structure, two stories in height, with a general air of decay; on the eastern side and adjoining it is a wooden house, used as a residence by the family of the proprietor. The back yard and out-houses of this hotel were filthy in the extreme.

August 29, a negro boy, fourteen years of age, who had been in attendance as a hostler at the Marion County Fair, returned to Columbia, and took up his position in the stables of the Winfrey House. After his arrival he was taken with a diarrhœa and made constant use of the privy in rear of the stables, to which nearly all the male portion of the community resorted as occasion demanded.

August 30, a negro man, the hostler in charge of the stables, was attacked with cholera, and died in a basement room of the Winfrey House after an illness of forty-eight hours. The same day, the boy to whom attention has already been called, was found under a shed in rear of the stables, fully collapsed. He died within six hours. Later in the day, a daughter of Winfrey, aged twenty years, was attacked and died in ten hours; and a white man, fifty years of age, who resided some fifteen miles from town, on Casey's Creek, but who was known to have used the stable privy on the 29th, was taken ill and died in ten hours.

August 31, J. C. Winfrey, the proprietor of both hotel and stables, was taken with cholera, from which he died in twelve hours. During the early hours of the same day, five members of the Winfrey family, and six boarders at the hotel, were attacked with the same disease. A total of twelve cases in one house, all being attacked within a few hours of each other. Eight died of the disease within eighteen hours. Three cases made tedious recoveries.

September 1, three persons who had lived at the Winfrey House were taken ill, two of whom died within sixteen hours. Doctor H. Owens, the rear windows of whose office opened into the stable yard opposite to the infected privy, died at his home in the country within twelve hours. The negro who had nursed the case of August 30, was attacked and died after an illness of fifteen hours. One case lingered for seven days, during which time he was removed some six miles into the country, where he died. A white man, fifty years of age, who had used the infected privy on August 30, died at his home on Green river, after fourteen hours' illness; and a young girl, twelve years of age, the daughter of the man who died on Casey's Creek (August 30), died after ten hours' illness.

September 2, a white boy, who had frequented the Winfrey House and stables was attacked, but made a slow recovery; and two white men, father and son, who had nursed the sick at the Winfrey House, were taken ill. The father, aged seventy years, died in sixteen hours; the son, aged twenty-five years, recovered. The same day, a white man, fifty years of age, who was known on some of the previous days to have used the stable privy, was taken with cholera at his home, some four miles in the country, and died in twenty-four hours.

During the three following days no new cases occurred.

September 6, a daughter of Mr. Winfrey, aged eight years, had a slight attack of cholera, but recovered.

September 8, four cases occurred, all of whom had been directly exposed to the infection of the Winfrey House. All recovered.

September 10, a white man and his wife, both aged about seventy years, were attacked. The man recovered, the woman died. How they had been exposed to the disease could not be discovered.

During the subsequent ten days no new cases were developed.

From September 20 to September 23, five cases occurred, all of whom had been directly exposed to the infection of the Winfrey House and stables. Of these cases *three* died. After the disease had become epidemic a general police of the town was made. The Winfrey House was closed; the stable was abandoned, after the privy had been disinfected and filled up with fresh earth. It is the opinion of the two physicians who remained in Columbia during the epidemic, that in the majority of the cases, the excreta were not disinfected, but were cast upon the ground.

October 27, on visiting the Winfrey House, and asking permission to visit the rooms in which the cases of cholera during the late epidemic had occurred, we found that no effort had been made at cleaning, beyond a washing of the bed clothing, and sweeping of the floor. The mattresses and other beds remained unchanged, carpets had not been removed, the walls had not been brushed. On examining the bed upon which Mr. Winfrey had died, some empty medicine vials were discovered.

The importance of prompt and immediate cleansing of these rooms and of the entire premises, was earnestly impressed upon the present manager; but it is extremely doubtful if the slightest attention will be given to any of the suggestions, although the hotel is now open and soliciting patronage.

CLINTON COUNTY. — The history of the epidemic of cholera as it occurred in Clinton County is meagre. From the few facts yet obtained, we learn that a gentleman returned from a visit to Nashville, late in June, to his home in the southern portion of the county. A few days after his return home he was attacked with cholera and died.

On the morning of August 31, Major A. M. Adair, Commonwealth Attorney for the Sixth Judicial District of Kentucky, who had been attending court at Columbia when cholera was developed in that town, who had lived at the Winfrey House, and had passed the previous night in the room with a cholera patient, started on horseback for Albany, Clinton County, in company of Judge T. T. Alexander. When a few miles from Columbia Major Adair was taken with pain in the abdomen, attended with nausea, which became more and more severe until five o'clock, P. M., when violent vomiting came on. He had ridden some fifteen miles since the symptoms first occurred, being desirous to reach the house of a friend, but was now obliged to dismount. A violent purging was established, and he was carried to a house near by and placed in bed. Cholera was fully developed, but Major Adair recovered after a tedious illness. Dr. Waggoner, of Bowling Green, who was summoned to the case, states that there was a total suppression of the urine for five days.

The house in which Major Adair was sick is situated on one of the spurs of the Cumberland mountains, twenty-six miles southeast of the town of Columbia, which was the nearest point of infection. The position of this house is so isolated, that the owner first learned of cholera being in the county by the arrival of Major Adair. No malaria could be found to produce the disease in this vicinity, yet we find that on September 8, Mr. K., the owner of this house, was taken sick with the same disease; lingered for four days, when he died. Two other members of the same family died from cholera within a few days. No other cases occurred in Clinton County as far as can be ascertained.

Washington County. — It has been found impossible to obtain full accounts of the epidemic as it affected Washington County. Springfield, the county town, nine miles north from Lebanon, with which town its inhabitants are in daily communication, escaped almost entirely.

August 31, a negro man, aged fifty years, who had attended the Marion County Fair, was taken with cholera and died after an illness of ten hours.

September 1, a white man, twenty years of age, residing within a few miles of town, died from cholera within twelve hours.

September 2, three negroes living in the Pleasant Run district, were taken with cholera and all died within thirty-six hours. These men had all been in Lebanon within a few days of their attack.

September 4, a prominent physician of the county, residing on Pleasant Run, who had been in constant attendance upon cases of cholera in Washington and Marion counties, was violently attacked. He lingered for twenty-four hours and died.

September 7, the daughter of Dr. Logan was attacked with cholera and died within seventy-two hours. During her father's illness she had been in constant attendance on him. After the death of this lady, her mother, child, and husband, were attacked with cholera, but all three recovered. These cases were followed by two cases of cholera among the servants of the family, both of whom died in a few hours. Dr. Logan and many of the members of his family had attended the Marion County Fair.

Boyle County. — So far as records can be obtained, no cases of cholera occurred in Boyle County prior to August 30, when a farmer in comfortable circumstances, living some six miles from Danville, was attacked, and after an illness of ninety-six hours recovered. This man had attended the Marion County Fair, and the disease was developed in him at about the same hour that it was in many of the Lebanon cases.

On the 1st of September, a young lady, eighteen years of age, who with other members of her family had left their home in Marion County on account of the cholera, was attacked, and made a slow recovery. The next day her father and brother were taken ill with the same disease, but both recovered.

September 3, a gentleman, also from Marion County, was attacked, but after an illness of ninety-six hours, reacted and recovered. These cases occurred about five miles west of the town of Danville. Each had attended the Marion County Fair, and had not left their homes until after the occur-

rence of the disease in Lebanon. In each the symptoms of the second stage were fully developed, collapse, although imminent, had been reached in none.

September 4, a young man, seventeen years of age, a student of Centre College, Danville, was attacked with cholera, while in his class-room. He had but a day or two previously arrived from his home in Lebanon, and had been present on each day's meeting of the Marion County Fair. This case also recovered. No other case occurred in the town of Danville. The sanitary condition of the town was good. The Boyle County Medical Society had made the necessary representations to the Town Trustees, and the Trustees had coöperated fully with the Society. A system of weekly inspections was instituted. The town was divided into districts to which were assigned a representative of each body, and all that might be prejudicial to the public health was removed.

September 5, a negro man, aged forty-five years, was attacked with cholera at the house of a friend, some six miles west of Danville, and died after an illness of eight hours. The day before he was taken sick, he had arrived from Adair County. He had been the body servant of Colonel Robert Miller, of Columbia, who had fallen a victim to the Winfrey House epidemic, on the 1st instant. The negro, after faithfully nursing his master, prepared his body for the grave, and after the funeral started for his friend in Boyle County.

No other cases occurred in the county.

MERCER COUNTY. — The reports from Mercer County are meagre. Five cases are reported as occurring in the town of Harrodsburg, from the 6th to the 15th of September. But one death is reported. All the cases occurred in the persons of negroes, and it has been found impossible to obtain any previous history of the individuals.

In closing this outline of the Kentucky epidemic we desire to acknowledge the aid and encouragement extended to us by the medical gentlemen of the State. It was imposing a task of no small magnitude upon busy country practitioners, to ask a full report of an epidemic, of which no notes of cases were kept at the time of occurrence, yet except in a single instance, the information was promptly furnished.

LEBANON, KENTUCKY, *November*, 1873.

Abstract of Records of Epidemic of Cholera in Kentucky in 1873.

Statistics by Ages.

Abortions produced by Disease.	Age. 1 Mo.	Age. 2 Mos.	Age. 3 Mos.	Age. 4 Mos.	Age. 1 Year.	Age. 2 Years.	Age. 3 Years.	Age. 4 Years.	Age. 5 Years.	Age. 5 to 10 Years.	Total under 10 Years.
5	1	2	2	3	3	10	5	4	4	30	64

Years. 10 to 20.	Years. 20 to 30.	Years. 30 to 40.	Years. 40 to 50.	Years. 50 to 60.	Years. 60 to 70.	Years. 70 to 80.	Years. 80 to 90.	Years. 113	Total over 10 Years.
98	147	117	124	74	48	18	3	1	630

Statistics by Sex.

Male.	Female.	White.	Black.	Recoveries.				Deaths.			
				White.		Black.		White.		Black.	
				Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
34	30	33	31	5	6	1	2	14	11	15	10

Statistics by Social Condition.

Male.	Female.	White.	Black.	Married.	Single.	Recoveries.				Deaths.			
						White.		Black.		White.		Black.	
						Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
339	291	362	268	367	263	107	69	23	28	108	99	101	95

Summary.

Deaths reported, but of which there is not sufficient data to admit of tabulation.

McCracken County	180
Bourbon County	76
Meade County	60
Total	316

REPORT UPON THE COURSE OF CHOLERA THROUGH TWO HUNDRED TOWNS AND CITIES IN THE MISSISSIPPI VALLEY, IN 1873.

By ADONIRAM B. JUDSON, M. D.,

Sanitary Inspector of New York.

The facts embodied in the following report have been derived chiefly from daily and weekly newspapers of the towns in which cholera made its appearance, and from manuscript reports of trustworthy medical observers, forwarded to the Secretary of the American Public Health Association. The latter sources of information were, of course, usually available subsequent to those in the public prints. In such cases the manuscript account has, through the courtesy of the secretary, been made use of in preference to that of the newspapers. In all cases where comparison has been possible, the observations of such medical contributors have been found to verify in most particulars, and to amend in others, the newspaper accounts. Where discrepancies have occurred, they have been in cases where the newspapers have understated, rather than overstated, the severity of the visitation. The following notes upon the cholera in the United States, in 1873, are therefore to be considered as falling short of, rather than exaggerating, the facts. The report is arranged, *chronologically* by States, as far as possible, and, under each State, *alphabetically* by towns. It having been impossible to exhibit the location of all of the towns on the accompanying map, the position of some of the smaller ones, in relation to more important places, has been described in the report.

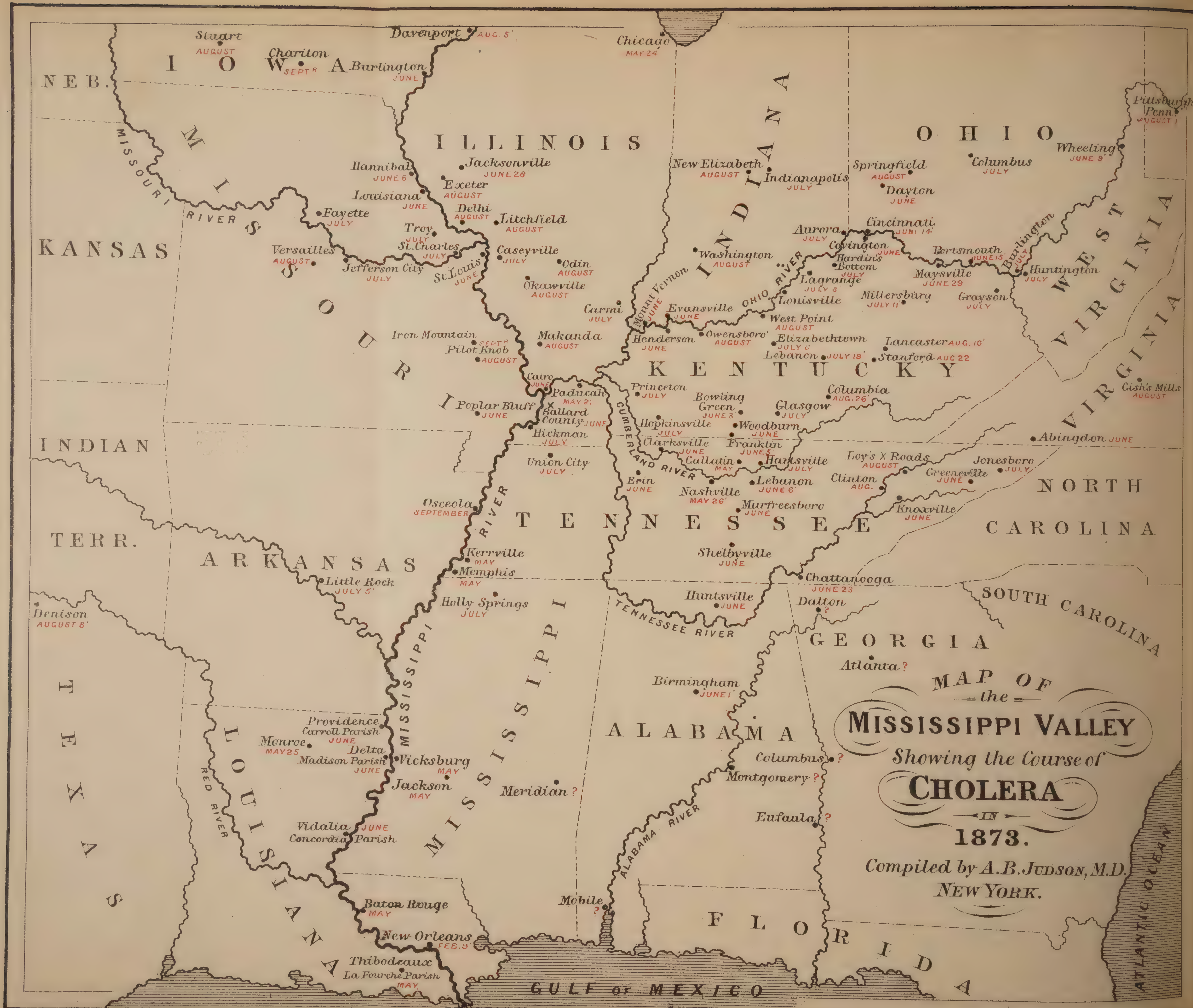
Many of the facts herein compiled were presented in weekly reports made to the Sanitary Bureau of the Health Department of New York, through the summer of 1873, while the disease was in progress and seemed likely to reach New York.

LOUISIANA.

Baton Rouge. "Weekly Gazette-Comet," May 31, 1873: "There have been some few cases of cholera morbus, or spasmodic cholera."

Delta, Madison Parish. "The Weekly Journal" gives the following facts: "A colored man died on the Crane plantation, of cholera, June 28. Up to July 1, there had been several deaths by cholera on the Utz plantation and quite a number on Roundaway Bayou." There was a death from cholera on Fortune's Fork plantation, July 7, and in the week ending July 29, ten or twelve colored persons died of cholera on the Ballard place.

Monroe, Ouachita Parish. Population, 1,749. The report of the sexton



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states that the first case of cholera occurred about May 25. In May there were sixteen deaths, and from June 1 to July 15, sixty-nine deaths. Total deaths from cholera, eighty-five.

New Orleans, Orleans Parish. Population, 191,418. The first death from cholera occurred February 9, 1873. See the report of C. B. White, M. D., President of the Board of Health.

Providence, Carroll Parish. Several deaths from cholera are reported in the weekly paper the latter part of June.

Thibodeaux, Lafourche Parish. Population, 1,922. The "Weekly Sentinel" gives the following facts: From May 10 to May 17, fifteen or more deaths from cholera occurred on the Oak Grove and Scudday plantations. In the latter half of May, seven deaths from cholera occurred on Mrs. Collins', and two on Harang's plantation. By the end of June there had been from forty to fifty deaths from cholera in the Parish, and five more occurred the first week in July.

Vidalia, Concordia Parish. The "Weekly Herald" states that from June 10 to June 21 there were ten deaths from cholera on the plantation of Mr. Lambden. Up to July 19, twenty-six cases and six deaths had occurred on Mr. David Miller's place.

MISSISSIPPI.

Holly Springs, Marshall County. Population, 2,406. The "Memphis Appeal" reports three deaths from cholera on July 6, two of them being children in one family.

Jackson, Hinds County. Population, 4,234. The "Weekly Clarion" reports ten white and thirteen colored deaths from cholera from May 20 to July 4.

Meridian, Lauderdale County. A death from cholera July 14, and other cases rumored.

Vicksburg, Warren County. Population, 12,443. The sexton's weekly reports give thirteen deaths from cholera in four weeks ending June 9, 1873.

ALABAMA.

Birmingham, Jefferson County. Population of the township, by census of 1870, is 1,055. The first case occurred about June 1. (See report of J. H. Van Deman, M. D., Health Officer of Chattanooga.)

Eufaula, Barbour County. Population, 3,185. The "Eufaula News" of June 16, states that the prevalent "painful bowel disease" has abated but little; and July 15, gives account of the death of a prominent man, from "cramp colic."

Huntsville, Madison County. Population, 4,907. The "Weekly Democrat" states that from June 1 to July 23, there were one hundred and ten deaths. Of these forty-two are stated to have been from cholera.

Mobile. The "Eufaula News" of June 5, states that it was cholera morbus and not Asiatic cholera, which caused alarm in Mobile the preceding week, and that there were many cases of cholera morbus or a disease resembling it throughout the country.

Montgomery. The "Columbus (Ga.) Sun," of July 27, reports two cases

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of cholera at Montgomery: "A negro buried his wife on Friday, at sunset, came home, was stricken with the disease, and died next morning by eight o'clock."

GEORGIA.

Atlanta. The "Constitution," July 3, gives details of a fatal case which came from Chattanooga.

Dalton. The "Columbus Sun" states that a traveller arrived from Chattanooga, July 2 in the morning, was taken sick at four P. M., and died at ten P. M. "His brother is now sick with the disease. Several bad cases of cholera morbus in town, but none have so far proved fatal."

Calhoun County. The "Eufaula News" states that a prominent lawyer of Eufaula died June 18 in Calhoun County, of "a very violent attack of cholera morbus."

Columbus. The "Montgomery (Ala.) Journal," July 30, 1873: "They have the 'cramp colic' at Columbus. One death last week from this cause."

FLORIDA.

The "Jacksonville Union" of July 1, mentions a death from cholera at Gainesville, and adds: "Fatal cases have also been reported at Cedar Keys, and elsewhere" in the State.

ARKANSAS.

Little Rock, Pulaski County. Population, 12,380. The first fatal case occurred July 5. (See Report of the Board of Health.)

Near Little Rock. July 25. (See Dr. J. A. Dibrell's Report.) "Little Rock Gazette," July 29, 1873: "It is also reported in medical circles that the disease is prevailing at Clear Lake, and through that neighborhood."

Osceola, Mississippi County. On September 20 it was reported at Memphis, Tenn., that cholera had prevailed at Osceola for several days, and that six or seven deaths had occurred there on September 19.

TENNESSEE.

Bellevue, thirteen miles southwest of Nashville on railroad. It was reported to the "Nashville Union and American" on July 1, that two deaths from cholera had occurred at Bellevue.

Brownsville, Haywood County. Population, 2,457, fifty-six miles northeast from Memphis. It was reported in the "Bee" that two children of a lady who had died of cholera at Memphis on May 26, and been buried at Brownsville, had been taken with cholera at Brownsville, and that one of them had died.

Carter's Station, Washington County, twelve miles east of Jonesboro on the railroad. It is reported in Knoxville papers that six deaths had occurred at Carter's Station from cholera, and that several persons (four in one family), were dangerously sick.

Celina, Overton County. Near the Kentucky line, on the Cumberland River, above Nashville. The "Gainsborough News" of July 25, says: "Some disease resembling the 'prevailing' is raging in the neighborhood of Celina."

Chattanooga, Hamilton County. Population, 6,093. The first case occurred June 23. (See Report of J. H. Van Deman, M. D., Health Officer.)

Clarksville, Montgomery County. Population, 3,200. The "Weekly Chronicle" gives details of ten fatal cases of cholera from June 21 to July 9.

Clinton, Anderson County. Population, 325. The "Knoxville Chronicle" reports two deaths from cholera up to August 7.

Corbandale, Montgomery County, fifteen miles northeast from Erin, on the railroad. The "Dover Record," July 18, reports three or four cases of cholera.

Ducktown, Knox County. Between Knoxville and Clinton. The "Knoxville Chronicle," July 23, reports that "a very violent cholera morbus prevails at Ducktown," and that "a considerable number of deaths had occurred."

Erin, Stewart County. It is said that the first attack of cholera occurred June 24, and that the population is ordinarily about one hundred, of whom fifty left at the first rumor of the disease. The "Dover Weekly Record" states that up to July 2, there had been seven white and seven colored deaths from cholera, and that during the second attack of the disease there were fourteen deaths from cholera from August 5 to August 8.

Farmington, Marshall County. Population, 919. About fifteen miles west of Shelbyville. The "Shelbyville Commercial" reports that the fourth death from cholera at Farmington occurred July 9.

Flat Creek Village, Williamson County. Population, 637. The "Shelbyville Commercial" reports two or three deaths from cholera during the first week in August.

Fountain Head, five miles from Knoxville. F. K. Bailey, M. D., in the "Nashville Medical and Surgical Journal," states that a family journeyed from Chattanooga to Knoxville and thence to Fountain Head. At Knoxville a boy was taken sick with diarrhœa, and at Fountain Head six deaths occurred in this family and among the neighbors.

Gallatin, Sumner County. Population, 2,123. The "Weekly Examiner" says that the first death occurred May 30, and that "the total deaths from cholera from May 31 to this date (July 12), at Gallatin have been one hundred and four, of which eighty-eight were colored and sixteen white." June 28: "With a disorganized force, and amid the awful scenes of death on every hand; in the almost painful quiet of our streets, only broken by the rattle of hearses, we have managed to issue daily bulletins as to the progress of the epidemic, as well as a half sheet of our weekly to our subscribers."

Galveston. Correspondence of Louisville "Courier-Journal," of July 4, states that the cholera has subsided at Galveston, Tenn.

Goodlettsville, Davidson County, thirteen miles north of Nashville on the railroad. The "Nashville Union and American" reports that up to July 3 there had been twenty-two deaths — eight white, fourteen colored, — from cholera at Goodlettsville.

Greeneville, Greene County. Population, 1,039. The first fatal case of cholera in Greeneville reported by the Knoxville and Greeneville papers, died June 11, after an illness of two days. In the following week there were thirteen deaths. The last fatal case reported occurred July 15. "National Union," July 31: "Below we give a full list of the cholera deaths in Greene-

ville, according to the most reliable records kept: Total white, thirty-two; total colored, seventeen; grand total, forty-nine." The following words are added: "We are acquainted with some fifty additional deaths through the county, so we think the grand total for our county would reach one hundred, that being a safe but not exaggerated estimate."

Near *Hartsville*, Sumner County. The "Gainsborough News," and "Louisville Courier-Journal" report the appearance of cholera on Little Goose Creek, about five miles north of Hartsville, on July 7. Eight deaths occurred, chiefly in one family.

Jonesboro, Washington County. Population, 1,445. Letter to E. Harris, M. D., from W. R. Sevier, M. D., October 1, 1873. "Some four or five weeks elapsed from the time of its departure from Greeneville before it assumed an epidemic form in our town. During this period quite a number of cases occurred in the intervening country, some of which were of very malignant character. Two cases, both of whom were refugees from Greeneville, occurred here some days prior to its actual development as an epidemic. One of these was of a violent character, the other was not. Both recovered. The first case among our resident population was the wife of a gentleman, who had waited constantly at the bedside of the first mentioned case in the capacity of nurse. The houses were a quarter of a mile apart. Those who believe the disease to be contagious impute the attack to the poison conveyed in the clothes of the husband. No other case occurred after that date (15th) until the 24th July, when it at once assumed an epidemic form. The period marked by the greatest fatality was from 29th July to August 1, inclusive of both dates." The "Jonesboro Herald and Tribune," gives a list of names and dates of fatal cholera cases in Jonesboro, from which is compiled the following table:—

Deaths from Cholera in Jonesboro, Tenn., in 1873.

Date.	Number of Deaths.	Date.	Number of Deaths.	Date.	Number of Deaths.
July 15	1	July 26	1	Aug. 1	5
20	1	27	1	2	2
23	1	29	5	3	1
24	1	30	4	5	2
25	1	31	2	6	1

Besides the above, four persons who contracted the disease at Jonesboro died,—two at Knoxville, and two on Little Limestone Creek, below Jonesboro. The "Jonesboro Herald and Tribune" adds: "From July 15 to August 6, thirty-four deaths occurred from the disease, which, taking into consideration the fact that not more than one hundred people remained in town during the prevalence of the disorder, shows a death-rate scarcely ever equalled."

Kerrville, Shelby County. The "Memphis Avalanche," May 9, 1873, reports: "The sudden death of about twenty hands on the Memphis and Paducah railroad, in the northern part of Shelby County, and the sickness of others, have alarmed the neighborhood. The cause is not known, but the facts are rather appalling." May 13: "Dr. Black, of Kerrville, Shelby County, on the Memphis and Paducah railroad, attended the laborers who died suddenly and whose death caused something like consternation in the northern part of this county. Dr. Black states that Mr. Ledbetter had charge of seventy-five Tennessee convicts, and fifty free laborers, who were working on the first twenty-one miles from Memphis. Patrick Smith had fifty hands and worked on the Covington end. Of all these seven convicts died, one white guard, and Mr. Smith. The doctor is of the opinion that the men died of malaria stirred up in the deep cuts filled with rotten wood and inhaled by them. In support of this theory he states that those who worked first in the cuts were the first to get sick; those who worked in the dump cars were the next that were attacked, and those who were not in contact with the dirt or the cuts escaped sickness. When the patient lived eighteen hours he was very likely to recover, but that in those cases which proved fatal the patients died within six or eight hours after the attack. The Tennessee convicts have been removed from the road because the disease is pronounced a local one. The free laborers can remain or not, as they please." (See Nashville, Tenn.)

Knoxville, Knox County. Population, 8,008. F. K. Bailey, M. D., reports eighteen fatal cases from June 24 to August 22, 1873.

Lebanon, Wilson County. Population, 2,073. "Cholera in Lebanon and Vicinity," by J. L. Fite, M. D., in "Nashville Medical and Surgical Journal": "Two young men came up from Nashville about the 6th of June. One of them was attacked with cholera on the 8th and died the same day; the other was attacked about the same time, and died several days after. The next case occurred in the person of a stout negro man seven days afterwards. . . . . He lived about fifteen hours. The epidemic then spread rapidly over the town, confining itself to no particular locality." The "Weekly Herald" states that the young man first mentioned as arriving from Nashville, "came up from that city on Friday's train (June 6). He was suffering from diarrhœa when he came." The "Weekly Herald" gives names, residences, and dates, "from official cemetery records," of cholera deaths occurring in Lebanon and its immediate vicinity. The following table is compiled from this list: —

Deaths from Cholera in Lebanon, Tenn., in 1873.

Date.	Number of Deaths.		Date.	Number of Deaths.	
	White.	Colored.		White.	Colored.
June 8	1	–	June 28	–	2
15	–	1	29	1	–
16	–	3	July 1	–	1
17	1	4	3	–	1
18	1	2	4	–	1
20	1	–	5	–	2
21	4	1			
24	–	1	Totals . . .	9	19
			Total		28

Near *Lebanon*, Wilson County. The "Weekly Herald" reports the following deaths from cholera in Wilson County, outside of Lebanon: At Shop Spring, June 27, one; June 29, one; July 5, one. Some time before July 2, at Huddleston's Cross Roads, one; at Silver Spring, one; near Taylorsville, one; July 2, three miles east of Lebanon, one; July 5, eight miles east of Lebanon, one; and on Cainsville Road, seven miles from Lebanon, one.

Limestone Station, Washington County, half way between Greeneville and Jonesboro. The "Knoxville Chronicle," August 3, 1873: "Three members of a family, living at Midway, were attacked with the dread 'prevailing,' and died, when the remaining members fled to Limestone, and have all since been attacked with the same disease in a very violent form."

Near *Loudon*, Roane County, twenty-eight miles southwest from Knoxville. The "Knoxville Chronicle" reports a fatal case of cholera six miles from Loudon, August 2.

Loy's Cross Roads, Union County. Population, 468. The "Knoxville Press and Herald," August 6, reports three deaths from cholera at Loy's Cross Roads on August 1.

Memphis, Shelby County. Population, 40,226. The history of the cholera in Memphis, in 1873, has not been written, probably because the medical men who survived the cholera were occupied with duties connected with the succeeding epidemic of yellow fever. The facts and surmises furnished by the newspapers are presented below. They give a very imperfect view of a severe and fatal epidemic. "Memphis Avalanche," May 18: "In the death of —— ——, our city lost yesterday one of its best and most progressive citizens. . . . . His death was the result of acute dysentery,

which compelled him to leave his place of business on Wednesday morning last (May 14), to which he was never to return." "Avalanche," May 20: "The prevailing epidemic, now sweeping over Memphis, bears the euphonious title of 'Strawberry Festival.'" May 29: "The cholera morbus excitement is not so intense as it was." "Memphis," June 4, — . . . . "No alarm was felt until yesterday, when the physicians generally agreed that it was cholera, some classing it as 'sporadic,' and others as 'Asiatic.'" On June 4, the Common Council refused to adopt a resolution passed by the Board of Aldermen, creating a Board of Health. June 16, both branches of the City Council adopted an ordinance creating a Board of Health.

The "Memphis Appeal," June 20: "How it came — . . . . It is stated that three emigrants from Hungary, on their way to Texas, four months ago, were landed and died in New Orleans of cholera. Therefore the dispatches from the Spanish Consul at New Orleans, to the Alcalde of Havana, which caused New Orleans vessels to be excluded from that port. This quarantine against New Orleans at Havana, was rigidly enforced two or three weeks before we heard of strangely sudden deaths in this vicinity. Then we are told two railroad laborers from New Orleans went to work on the Paducah Road, fifteen miles north of Memphis. (See Kerrville, Tenn.) These brought with them, from New Orleans, seeds of disease imported by the Hungarians. Other laborers were attacked, and thence the infection or contagion spread over the whole limestone watered region of the United States." The "Memphis Appeal" gives the following causes of death from books of the undertakers from June 6 to 13, both days inclusive: —

Cholera . . .	38	Summ'r Complaint	1	Suicide	1	Measles	2
Cholera Morbus	11	Unknown . . .	21	Old Age	1	Dyspepsia . . .	1
Cholera Infantum	6	Dysentery . . .	6	Teething . . .	3	Heart Disease .	1
Congestion . .	7	Insanity . . .	1	Flux	1	Debility	5
Consumption .	4	Premature Birth .	1	Apoplexy . . .	1	Comp. of Diseases	1
Meningitis . .	1	Small Pox . . .	1	Chronic Diarrhœa	1	Inflamm. of Brain	1
						Total . .	119

Week ending June 8, 1873, 55 interments.
Corresponding week, 1872, 26 interments.
Average weekly for 1872, 19 interments.
June 9, 11 interments.
June 10, 18 interments.
June 11, 24 interments.
June 12, 19 interments.
June 13, no report.
June 14, 12 interments.
June 15, 21 interments.
June 16, 19 interments (cholera and cholera infantum, 15).
June 17, 15 interments (cholera, 10).
June 18, 15 interments (cholera, 11).
June 19, 33 interments (cholera, 19).
June 20, 24 interments (cholera, 17).
June 21, 14 deaths from cholera.
June 22, 19 interments (cholera, 9).
June 23, 8 interments from cholera.
June 24, 20 interments (cholera, 13).
June 25, 14 interments from cholera.
June 26, 7 interments from cholera.
June 27, 9 interments from cholera.
June 28, 12 interments (cholera, 8).

June 29, 4 interments from cholera.	July 5, 13 interments (cholera, 5).
June 30, 22 interments (cholera, 7).	July 6, 15 interments (cholera, 6).
July 1, 19 interments (cholera, 8).	July 7, 22 interments (cholera, 3).
July 2, 25 interments (cholera, 11).	July 8, 1 interment from cholera.
July 3, 20 interments (cholera, 6).	July 9, 3 interments from cholera.
July 4, 2 deaths from cholera.	July 12, 5 interments (cholera, 2).

According to the above mortuary reports, manifestly imperfect as they are, there were in Memphis in six weeks, from June 1 to July 12, five hundred and twenty-two deaths, of which two hundred and twelve were caused by cholera.

Midway, Greene County, nine miles west of Greeneville, on railroad. Population, 752. The following is quoted from the "Knoxville Chronicle:" "Midway, Tenn., August 4, 1873. . . . . There have been only three or four cases of cholera immediately in the village, one only proving fatal, and that was a colored boy that was living with me. He was taken sick on the morning of the 18th of July, and died within fourteen hours, of sporadic or Asiatic cholera. To give you some idea of the fatality of the disease, I inclose a draft representing one square mile, including all the deaths from cholera in this immediate vicinity. This includes a population of about eighty-five persons, all told, twelve of whom died of cholera within twenty-two days, six of cholera morbus and six of sporadic cholera. The entire population of the families of whom these twelve died, number forty-eight persons. On the 18th and 19th of July, five died of sporadic cholera, including the boy at my house, and the wife and three children of John G. Hahn, a tenant on my farm. Forty-eight hours from the time the first one was attacked all five were dead, and only thirty-four hours from the death of the first the fifth one was a corpse. The wife and two children were buried in one grave, the three dying within twelve hours. Mr. Hahn and his only living child is at my house. The child is convalescent from cholera, and I think will recover. Mr. Hahn has not had the cholera. . . . . The inclosed drawing represents a small section of limestone country, including a branch heretofore known as the Seven Springs, but now known as Cholera Branch. The citizens of Midway all use cistern water. My work hands had been using water out of a freestone spring, but from some cause unknown, the colored boy and Mr. Hahn's family drank out of Cholera Branch, in which it is said some cloths had been thrown from those that had died. Two days after they had thus drunk the five were dead."

Morristown, between Knoxville and Greenville. The "Nashville Banner," June 18, reports two cases at Morristown.

Mosheim, Greene County, seven miles west of Greeneville. Letter already quoted (see Midway): "There have been eight deaths from cholera at Mosheim." "Knoxville Press and Herald": "One family, composed of husband, wife, and child, all died."

Murfreesboro, Rutherford County. Population, 3,502. The "Monitor" gives names and dates of fatal cases of cholera in Murfreesboro, from which the following table is compiled:—

Deaths from Cholera in Murfreesboro, Tenn., in 1873.

Date.	Number of Deaths.		Date.	Number of Deaths.	
	White.	Colored.		White.	Colored.
June 17	–	1	July 6	–	4
18	–	1	7	–	2
20	–	1	8	–	5
29	–	1	9	–	2
July 1	–	2	24	–	1
2	1	4	25	1	1
3	1	2			
5	–	5	Totals . . .	3	32
			Total		34

Near *Murfreesboro.* The "Monitor" gives facts from which the following table, of deaths in the country near Murfreesboro, is compiled: —

Deaths from Cholera in the Country near Murfreesboro in 1873.

Date.	Number of Deaths.		Date.	Number of Deaths.	
	White.	Colored.		White.	Colored.
June 18	–	1	July 4	–	3
23	–	1	6	–	1
28	–	3	8	1	–
30	–	1	9	1	2
July 1	–	1	24	–	1
2	1	2			
			Totals . . .	3	16
			Total		19

In addition to the deaths above tabulated, the "Monitor" reports three deaths (whites) from cholera in the Big Spring district, six or eight miles southeast of town, on August 5, and three deaths from cholera on a farm, on the Jefferson Turnpike, about ten miles north of Murfreesboro, in the week ending September 6.

Nashville, Davidson County. Population, 25,865. A history of the cholera in Nashville in 1873, is given by W. K. Bowling, M. D., in the "Nashville Medical and Surgical Journal." The first fatal case marked by cholera symptoms, mentioned by him, occurred May 26. The patient died May 29. From May 29 to June 7 he reports six fatal cases, and states that the deaths of some negroes were reported about the same time. From June 7 to the close of the epidemic, the number and dates of fatal cases of cholera are derived from the Nashville newspapers. The totals are: Whites, two hundred and forty-four; colored, four hundred and three; grand total, not counting the deaths prior to June 7, six hundred and forty-seven.

The "Louisville Courier-Journal," of July 1, 1873, states: "Nashville, June 30. The cholera is now almost wholly confined to the Penitentiary just outside the city limits, seventy-five convicts being down with it. Only nine deaths have resulted from the disease in the institution during June. It is believed by many that the convicts who contracted what was then supposed to be the malarial fever on the Memphis and Paducah road, and were sent here a month ago to recruit their health, brought the cholera to Nashville, the fever or the cholera being one and the same." (See Kerrville, Tennessee.)

Old Union, Shelby County. The "Memphis Ledger" reports six deaths from cholera at the residence of —— ——, Old Union, near Cuba, and fatal cases among the negroes at the "Noblin Place."

Ooltewah, Hamilton County, seventeen miles east of Chattanooga, on railroad. Population, 1,102. The "Knoxville Chronicle," July 25, reports two deaths from cholera at Ooltewah on July 22, and adds: "This makes four or five deaths from the 'prevailing,' reported at that place during the past week." The "Chronicle" also reports a fatal case at Ooltewah the 5th of August.

Palmyra, Montgomery County, sixteen miles northeast of Erin, on the railroad. The "Dover (Tenn.) Weekly Record," July 4, 1873, says: "Twelve deaths are reported to have taken place at Palmyra from cholera since it commenced."

Raccoon Valley, Union County, near Maynardsville, twenty miles northeast from Knoxville. A Knoxville paper reports the death from cholera of Mr. Pleas. Miller and Dr. Lewis, and the occurrence of five other cases, three of them in a critical condition.

Richland, Sumner County, fifteen miles north of Gallatin, on the railroad. The "Gallatin Examiner, Extra," of June 19, reports four deaths from cholera at Richland.

Rogersville Junction, Hawkins' County, eighteen miles west of Greeneville, on the railroad. The "Knoxville Press and Herald" reports the death from cholera, at Rogersville Junction, August 1, of a man whose daughter died during the week ending July 26, of the same disease. Also fatal cases August 25 and 26.

Sharp's Settlement, Campbell County, between Loy's Cross Roads and the Kentucky line. The "Knoxville Chronicle," August 5, reports the death from cholera, at Sharp's Settlement, of a man from Raccoon Valley.

Shelbyville, Bedford County. Population, 1,719. The "Weekly Commercial" gives the following facts in regard to cholera: "The first fatal case occurred about June 6, the second on June 17. Up to June 21 there were seven fatal cases, and from June 21 to July 11, there were (nineteen white and forty-three colored) sixty-two deaths from cholera. The disease then almost entirely disappeared until the death, on August 2, of two well-known residents, members of the same family. They were taken sick at 10 P. M., and died early the next morning."

Springfield, Robertson County. Population, 2,140. The "Weekly Record" reports deaths from cholera as follows: "June 18, one; 20, one; 21, one; 23, one; 24, one; 26, three; 27, one; 29, one; 30, two. Whites, three; colored, nine; total from June 18 to June 30, twelve." July 14, an old citizen of the county died from cholera near Bethlehem Church.

Telford's Station, Washington County, five miles west of Jonesboro, on the railroad. The "Knoxville Press and Herald" reports a death from cholera, August 4.

Union City, Obion County. Population, 2,479. The "Louisville Courier-Journal" reports two deaths from cholera at Union City, Tennessee, on July 16. The "Union City Weekly Courier" reports twenty-nine cholera deaths in the week ending July 25. The "Courier-Journal" reports as follows: five deaths in the country around Union City on July 30; and fifteen in the week ending August 8; four deaths in Union City on August 11, and three on August 14. The "Weekly Courier," August 15, 1873: "This fearful disease still lingers in our midst. . . . . It is now more than six weeks since the first case of cholera occurred in this city. . . . . The whole number of deaths from cholera in the city limits since its first appearance to date is fifty-one."

Wallace's Cross Roads, Anderson County, twenty miles northwest of Knoxville. Population, 791. The "Knoxville Press and Herald" reports the death, from cholera, of a prominent man August 29, and the death of another man resident in the same house on August 30; also a death from cholera in the same vicinity September 12, and the occurrence of several cases which recovered, among them a son of the first mentioned case.

Whitesburg, Jefferson County, between Knoxville and Greeneville, on railroad. Population, 518. The "Knoxville Press and Herald" reports the death from cholera of a resident of Whitesburg, the sickness of his child, and the death, on July 10, of his mother-in-law.

Winchester, Franklin County, thirty miles southeast from Shelbyville, on railroad. The "Shelbyville Commercial" reports two deaths from cholera on July 27.

On Wolf River, near the Kentucky line, south of Columbia, Kentucky. The "Columbia (Kentucky) Spectator," July 3, 1873, reports several deaths from cholera.

KENTUCKY.

Ballard County. The "St. Louis Democrat" reported the following: "Cairo, July 2. Four men belonging to the force at work on the Mississippi Central Railroad extension in Kentucky, six miles below Cairo, died

last night from cholera, and several others are reported dangerously ill from the same disease." The "Cairo Bulletin," of July 6, reported: "Out of a camp of twenty men, in less than three days, nine of them died; and in the other camps the men died in the same proportion. In all probably twenty men died from Monday morning (June 30), to Thursday night (July 3), when the men were disbanded, the camps broken up, and the works, for the time being, deserted.

Bowling Green, Warren County. Population, 4,574. First case, June 3. See Report of Ely McClellan, M. D. "History of Cholera in Twenty Counties in Kentucky."

Boone County. "Paris Kentuckian," July 16, 1873: "Three cases of cholera have occurred near North Bend in Boone County, all colored people, all in one house, and all fatal."

Boyle County, between Lancaster and Lebanon. First case August 30. See Report of Ely McClellan, M. D.

Bryantsville, Garrard County, seven miles northwest of Lancaster. Population, 2,656. The "Owensboro Monitor," August 27, 1873, states that "Mount Vernon and Bryantsville are also similarly affected" (as Lancaster). The "Lancaster News" reports a death from cholera on September 2, at Bryantsville.

Burkesville, Cumberland County, twenty-five miles south of Columbia. Population, 2,774. The "Weekly Courier" reports the death of a negro from cholera on September 10.

Cadiz, Trigg County, twenty miles west of Hopkinsville. Population, 680. The "Princeton Banner," July 24, 1873, reports: "There have been fifteen deaths in Trigg County from cholera during the past four weeks; six at Rockcastle; three at Trigg Furnace; four at Cadiz, and two elsewhere."

Columbia, Adair County. Population, 506. T. Q. Walker, M. D., states, in a letter to Dr. E. Harris, of New York, that "the first case was Tom Montgomery, forty years old, colored, taken sick August 26, died August 29. His place at the stable was taken by the boy Tom, who was taken sick August 29." See Report of Ely McClellan, M. D.

Covington, Kenton County. Population, 24,505. The "Weekly Journal" reports "a few fatal cases of cholera" in the week ending June 28, and the death from cholera of a mother and son, the latter on July 7, after an illness of ten hours, and the former on July 8, after an illness of seven hours. The "Cincinnati Commercial," July 17, says the cholera in West Covington "is said to be on the increase, and as many as fourteen deaths are reported for the past two weeks." The "Commercial" reports, July 23: "Covington. Four more cases of cholera have come to light, two of them fatal. They all occurred in one neighborhood, and within the past two or three days." The "Weekly Journal," July 26, reports: "The cholera lingers in the city. A few cases have occurred during the week."

Dekoven, Union County, southwest of Henderson. The "Union County Advocate" reports the occurrence of several cases of cholera, and one death at or near Dekoven, or Shotwell's Mines.

Elizabethtown, Hardin County. Population, 1,743. First case, July 8, 1873. (See Report of Ely McClellan, M. D.)

Frankfort, Franklin County. The "Yeoman," July 8, reports the sudden death of a man with choleraic symptoms.

Franklin, Simpson County. Population, 1,808. First case June 5. (See Report of Ely McClellan, M. D.) The "Weekly Patriot" gives mortuary lists from which the following is compiled:—

Deaths from Cholera in Franklin, Ky., in 1873.

Date.	Number of Deaths.		Date.	Number of Deaths.	
	White.	Colored.		White.	Colored.
June 22	1	–	July 8	1	1
25	3	–	10	–	1
26	1	–	11	1	1
27	1	1	12	–	1
28	1	1	13	–	1
July 1	5	2	16	1	–
2	2	1	17	1	1
3	1	2	18	–	1
4	2	4	20	–	1
5	3	1	21	–	1
6	1	1	22	–	1
7	3	2			
			Totals . . .	28	25
			Total		53

The "Weekly Pantagraph" reports a death from cholera in Franklin, August 4.

Near *Franklin*. The "Bowling Green Democrat" reports several deaths from cholera in the southwestern portion of Simpson County, in the week ending August 2. "There were altogether one hundred deaths from cholera, in Franklin (town) and Simpson County.

Near *Glasgow*, Barren County. The "Glasgow Weekly Times" gives the following facts in regard to cholera: From July 1 to 5 there were six sudden deaths from cholera in a colored settlement on the Woodsonville Road, a mile and a half north of Glasgow. On July 22, the son of a prominent citizen died of cholera at his father's residence, four miles from town. On August 4 and 5, three deaths from cholera occurred in the neighborhood of Beaver Creek Bridge, about three miles north of Glasgow. On August 12, 19, and 21, three colored persons died of cholera, eight miles

southwest of Glasgow, on Beaver Creek. Total deaths from cholera, in the country, near Glasgow, from July 1 to August 21, thirteen. No cases occurred in Glasgow.

Grayson, Carter County. Population, 152. The "Vanceburg Kentuckian," July 11, 1873, says: "Several cases of the cholera in Carter County. We are informed that twenty-one persons have died with the disease at Grayson, generally negroes. One case has been reported at Olive Hill.

Hardin's Bottom, Henry County. The "Frankfort Yeoman" reports eleven fatal cases of cholera at Sand Ripple and Hardin's Bottom, a neighborhood on the Kentucky River and Henry County, from July 12 to July 21. "The cases that proved fatal died in from six to twelve hours after being attacked." A family which had fled from the cholera returned in due time; but two or three days after they reoccupied their house at Sand Ripple, two of them died of cholera, August 11, and before August 15 a third member of the family died at Union Church, where he had gone to bury the two bodies, and two others of the family died, six miles from home, as they were fleeing for safety.

Harrodsburg, Mercer County. (See Report of Ely McClellan, M. D.)

Hartford, Ohio County, twenty miles southeast of Owensboro. Population, 511. The "Frankfort Yeoman," July 29, 1873, says: "The disease still lingers at Princeton, Covington, Worthville, Hartford, and one or two other places in this State."

Henderson, Henderson County. Population, 4,171. The "Weekly News" furnishes the following facts: "There were deaths from cholera as follows: June 23, one; June 28, one; June 30, one; July 1, one; and July 2, one. In the week ending July 15, there were fourteen deaths in Henderson, some of which, perhaps all, were from cholera. On July 25 and 26, a father and daughter died of cholera."

Hickman, Fulton County. Population, 1,120. The "Weekly Courier" reports three cholera deaths: on July 28, and August 12 and 13.

Hopkinsville, Christian County. Population, 3,136. The "Weekly New Era" reports as follows: "There were five fatal cases resembling cholera up to July 21. There was a fatal case of cholera on August 4, and two on August 6, and another, the date of which is not given. There were two deaths from cholera in the week ending August 15. The above cases occurred in Hopkinsville."

Jamestown, Russell County, fifteen miles southeast of Columbia. Population, 138. The "Lebanon Weekly Standard" reports six or seven severe cases of cholera at Jamestown, on the 21st and 22d of September.

Lafayette, Christian County, fifteen miles southwest of Hopkinsville. Population, 215. The "Dover (Tennessee) Weekly Record" reports the death, from cholera, of two colored women at Lafayette, August 24.

Lagrange, Oldham County. Population, 612. First case, July 8. From July 8 to 29, there were thirty-one cases, fifteen of which were fatal. (See Report of Ely McClellan, M. D.)

Lancaster, Garrard County. Population, 741. The "Weekly News" gives mortuary reports from which the following table is compiled:—

Deaths from Cholera in Lancaster, Ky., in 1873.

Date.	Number of Deaths.		Date.	Number of Deaths.	
	White.	Colored.		White.	Colored.
Aug. 15	1	1	Aug. 27	1	1
16	–	1	29	1	1
19	–	3	30	1	1
20	1	3	Sept. 2	–	1
21	–	4	3	–	1
22	3	2	4	–	1
23	2	1			
24	2	–	Totals . . .	12	21
			Total		33

The first case occurred August 10. (See Report of Ely McClellan, M. D).

Larue County, between Lebanon and Elizabethtown. The "Elizabethtown Weekly News" reports the death of one negro, from cholera, at Marshall's, and two at Goodin's, August 5, in Larue County.

Lebanon, Marion County. Population, 1,925. First case died July 19, second case died August 11. (See Report of Dr. Ely McClellan.)

Logan County, between Franklin and Hopkinsville. The "Russellville Herald" gave the following facts: "In South Logan, in the neighborhood of Red River Church, and around Shocco, near the Tennessee border, the cholera is prevailing to an alarming extent." In this neighborhood, twenty-eight deaths, from cholera, are reported from July 17 to August 23.

Louisville, Jefferson County. Population, 100,753. (See Report of Dr. McClellan.) The "Courier-Journal," July 4, reports the arrival of the steamboat *J. D. Parker*, from the Mississippi River, having had two deaths and several cases.

Maysville, Mason County. Population, 4,705. First case, June 29. (See Report of Dr. Ely McClellan.)

Near *Maysville*. The "Maysville Bulletin" reports the death, from cholera, of two members of a well-known family, living near the North Fork Bridge, on July 4 and 9, and the occurrence on July 13, of a third case, which recovered.

Metropolis. The "Paducah Kentuckian," July 11, 1873, reports that several cases of cholera had occurred at Metropolis.

Middletown, Bourbon County. Population, 492. A death from cholera, at Middletown, was reported August 17.

Millersburg, Bourbon County. Population, 675. First case July 11. (See Report of Dr. Ely McClellan.)

Mount Vernon, Rock Castle County. (Twenty-five miles southeast of Stanford, on railroad.) Population, 252. (See Bryantsville, Ky.)

Nelson County. Between Lebanon and West Point. (See Report of Dr. Ely McClellan.)

Newport, Campbell County. (Opposite Cincinnati, O., and east of Covington.) Population, 15,087. The "Weekly Leader" June 21, 1873, reports the prevalence of cholera morbus in Newport. "The Leader," August 9, says: "There is more sickness now among the hands at the Licking River saw-mill than there has been for years. There has been, on an average, for the last month, four men off, from sickness, every day; the disease being cholera, cholera morbus, or whatever the severe current bowel complaint may be termed. Within four weeks there have been six deaths by cholera within one square of the Licking River saw-mill."

Oddville. "The Paris Kentuckian" reports two sudden deaths, at Oddville, from cholera, July 10 and 13.

Olive Hill, Carter County. Seven miles west of Grayson. Population, 737. See Grayson, Ky.

Owensboro, Daviess County. Population, 3,437. The "Weekly Monitor" reports nine fatal cases of cholera in Owensboro from the middle of August, to about the 7th of September.

Paducah, McCracken County. Population, 6,866. First case May 21. (See Report of Ely McClellan, M. D.)

Princeton, Caldwell County. Population, 1,012. The "Weekly Banner" reports cholera deaths in Princeton as follows: July 19, one; 22, one; 27, two; 30, five. The "Paducah Kentuckian" reports two deaths on July 31, and August 1, and, on August 7, states that the cholera is on the increase at Princeton.

Republican. The "Lancaster News" reports a cholera panic at Republican.

Rockcastle, Trigg County. Population, 80. (See Cadiz, Ky.)

Stanford, Lincoln County. Population, 752. First case August 22. (See Report of Dr. Ely McClellan.)

Taylor County, between Lebanon and Columbia. First case July 17. (See Report of Dr. Ely McClellan.)

Washington County, north of Lebanon. The "Lebanon Standard" reports two deaths from cholera September 29 and 30, the former on Beech Fork, and the latter on Pleasant Run, in Washington County.

West Point, Hardin County. Population, 206. The "Shelby (Ky.) Courant," September 4, 1873, states that, "In Hardin County, near West Point, on Sunday week (August 24), eighteen railroad hands were buried; and on Monday (August 25), twelve more, all deaths from cholera; and some six miles further on, there were ten or fifteen more deaths last week." These deaths are said to have been among railroad laborers.

Woodburn, Warren County. Population, 1,352. The "Bowling Green Democrat" prints a letter dated Woodburn, July 2: "Counting those with the first symptoms, I make somewhere near sixty cases in this place, from which our physicians have lost eight, up to eight o'clock this evening."

Worthville, Carroll County, twenty-eight miles east of Lagrange, on rail-

road. Population, 417. The "Louisville Courier-Journal" reports the sudden death of a negro railroad hand at Worthville, from cholera, on July 23. (See Hartford, Ky.)

MISSOURI.

Columbia, Boone County, twenty-five miles southeast from Fayette. Population, 2,236. The "Weekly Statesman," September 19, reports that four deaths, after a brief and severe illness, occurred on September 13.

Fayette, Howard County. Population, 518. The "Weekly Advertiser" states that from July 17 to 31, there were seven white and nine colored deaths from cholera, and that "on Monday, August 18, the pestilence again broke out in a family which had returned to town. Four deaths occurred in this house in twenty-four hours." The "Advertiser" of September 4, prints a letter from U. S. Wright, M. D.: "Up to date there have been in this town forty deaths from cholera, with perhaps seven deaths occurring in the country within a few miles from town."

Hannibal, Marion County. Population, 10,125. In a letter to Dr. E. Harris, from James G. Hickman, M. D., Hannibal, August 12, 1873, Dr. Hickman says: " . . . . The first case was June 6, a negro man, aged sixty years, recovered. Lost in his family, in close succession, wife and two grown daughters. Second case, a family young man, first thought to have sporadic cholera, lived several days and died from uræmia; his mother died in twenty-four hours afterwards. Third, stout male, aged forty, taken suddenly and died in eight hours, no more cases taking place in the family. Fourth, family man, aged fifty, taken suddenly and died in nine hours, one more case in two days in the same family, died in seven hours. We have had some sixty-five deaths since the disease visited us, and all but five cases were in the Fourth Ward, known as South Hannibal. In most all the families several members suffered, and Union Street was the greatest sufferer. The disease is yet with us."

Hogan Mountain, Iron County, nine miles south of Pilot Knob, on railroad. "Ironton Weekly Enterprise" of October 16, 1873: "It is said that several cases of cholera occurred in the vicinity of Hogan Mountain during the past two or three weeks, two or three of which were fatal."

Iron Mountain, St. Francois County, five miles north of Pilot Knob, on the railroad. The "Ironton Weekly Enterprise" states that five deaths from cholera occurred in one family at Iron Mountain, September 21 and 22.

Jefferson City, Cole County. Population, 4,420. The "Missouri Republican" states that six cases of cholera and three deaths had occurred in the Penitentiary at Jefferson City up to July 31, and that on that day a fatal case occurred in the city. The "Jefferson City Tribune" states that up to August 13, four deaths from cholera had occurred in the prison.

Louisiana, Pike County. Population, 3,639. The "Weekly Journal," June 21: "There have been five cases of sickness in this city, three resulting fatally, with symptoms resembling cholera. Four of these cases were grown colored persons, and one a little boy. Three of the adults came

from St. Louis." The "Journal" gives twenty-seven deaths from cholera up to July 26.

Mill Spring, Wayne County. The "Ironton Weekly Enterprise" reports (June 26) that one or more cases of cholera had occurred at Mill Spring, and (July 3) that four cases had proved fatal.

Pilot Knob, Iron County. Population, 581. The "Ironton Weekly Enterprise" reports that two fatal cases in adjoining houses occurred on August 7 and 8, that up to September 8, "between forty and fifty persons had fallen victims to the terrible destroyer;" and that on September 10 and 11, five or six persons died each day. "Mrs. M—— was called upon to part with her husband and three children, leaving only herself and one child out of a family of six."

Poplar Bluff, Butler County. Population, 840. The "Ironton Weekly Enterprise" reports that cholera was raging at Poplar Bluff the latter part of June; that three deaths occurred in one day in the week ending June 21, and fifteen deaths occurred the week ending June 28. The "St. Louis Dispatch" states that thirty deaths occurred at Poplar Bluff. "The mortality was chiefly confined to railroad hands, but several citizens had died."

St. Charles County. The "St. Charles Weekly News" reports, July 17, that between fifteen and twenty deaths from cholera had occurred the preceding two weeks in the county below Portage; July 24, that "cholera, or a disease very similar and equally fatal, prevails to an alarming extent in Lincoln and Pike counties and the point portion of this (St. Charles) county;" and July 31, that one death and several cases (cholera morbus) had occurred on the steamboat *S. H. Long*, lying at the wharf at St. Charles. The boat was ordered off and went up the river.

St. Louis. Population 310,864. The "Missouri Republican," June 20, reports that at a meeting of the Board of Health, one of the members "said there were a few cases of cholera morbus in the city, and three or four at the City Hospital." He suggested a special ward for the cases in the hospital. The "Republican," July 7, describes the cholera as it affected a family on the Gravois Road, near Second Carondelet Avenue. "On Saturday night, July 5, the two children, a boy and a girl, aged seven and nine respectively, were taken sick, purging and vomiting. After six hours sickness they both died. The father and hired man then took sick with the same complaint. They both died in a few hours' time, after suffering terribly. The mother then took sick, and at six o'clock last night she, too, died, leaving no one behind of the entire family." This family drew their drinking and cooking water from a filthy pool of stagnant water.

For the nine weeks ending September 13, there were reported in St. Louis papers one hundred and ten deaths from cholera, and two hundred and fifty-two from cholera morbus.

Mortuary Table compiled from St. Louis Newspapers in 1873.

Week Ending.	Total.	Cholera.	Cholera Morbus.	Cholera Infantum.	Summer Complaint.
June 14	107	–	8	4	–
21	159	–	11	25	–
28	255	–	25	30	40
July 5	241	–	49	–	57
12	241	–	67	10	33
19	292	14	69	–	43
26	252	21	32	25	23
Aug. 2	211	17	29	26	10
9	236	18	31	37	5
16	206	19	26	37	7
23	193	9	23	22	6
30	204	4	16	21	12
Sept. 6	185	6	15	16	7
13	185	2	11	15	5
20	143	–	8	6	2
27	147	–	1	7	2

Sturgeon, Boone County, twenty-five miles east of Fayette. The "Missouri Republican" of September 13, reports the death from cholera of two of the best citizens of Sturgeon.

Troy, Lincoln County. Population, 703. The "Missouri Republican" of July 21, reports that nineteen white and four colored persons had died from cholera at Troy and in the immediate vicinity.

Versailles, Morgan County. Population, 503. The "Missouri Republican," August 28, reports the adjournment of "Circuit Court at Versailles on account of cholera."

TEXAS.

Denison, Grayson County. A letter from James Johnston, M. D., Denison, May 2, 1874, states: "The first fatal case of cholera that came under my notice in this place occurred about the 8th August, 1873. Some few cases occurred occasionally up to the 20th September, when it assumed greater violence, and in the next twenty days we had about eighty deaths in this town, which had a population at that time of about three thousand. The disease subsided very rapidly, owing probably to change of weather and sanitary measures, and the last occurred about the 1st of November.

The proportion of deaths to cases amounted to about eighty per cent. . . . . The greater part of the cases that occurred manifested the symptoms of true Asiatic cholera. The patient was attacked with diarrhœa, followed by vomiting. The discharge from the bowels was generally what has been called 'rice-water,' the skin growing cold by degrees, with cramps usually, collapse arriving with intense thirst, oppression in breathing, loss of voice, disappearance of the pulse, suppression of urine, cold, blue, and shrunken skin, sometimes bathed in sweat, and at last cold breath and tongue. Almost all the cases I saw, and especially the fatal ones, were among the improvident and those who were in the habit of drinking bad whiskey. The city at the time was in a very filthy condition, and the houses where the largest number of cases occurred were remarkable for the amount of filth that had accumulated on the back premises.

The town is generally supplied by water from private wells, and I could not trace its cause to this source. I have no sufficient reason to believe that the disease was imported, although this is quite possible, as we had railroad connection at the time with Missouri, Tennessee, and Kentucky, and emigrants were coming here from these places. The Missouri, Kansas, and Texas Railroad, which runs from St. Louis through the Indian territory, entering Texas on the north, was the only through line of railroad completed at the time from these places."

Sherman, Grayson County. Population, 1,439. The letter from Dr. Johnston, quoted above: "The disease did not appear in any adjacent town except two or three cases that occurred in Sherman, a distance of ten miles (supposed to have been imported from Denison)."

IOWA.

Burlington, Des Moines County. Population, 14,930. Cholera appeared in this city about June 20, and caused about thirty-eight deaths.

Chariton, Lucas County. Population, 1,728. The "Chicago Times" reports "several cases of sporadic cholera" in Chariton, in the week ending September 16.

Davenport, Scott County. Population, 20,038. In a letter to E. Harris, M. D., from J. W. H. Baker, M. D., November 5, 1873, Dr. Baker says: . . . . "Our first case of cholera occurred about the 5th of August; was left at our boat landing by a steamboat from St. Louis. . . . . During the last week in August several residents of the city were attacked, and then for the first two weeks in September followed quite a cholera panic. Probably there were near two hundred cases of cholera if we were to include choleraic diarrhœa, and out of this number about eighty died." Dr. Baker states that the second case was a traveller who lodged at a hotel about eight or ten days after the occurrence of the first case.

Stuart, Adair County. "The Weekly Locomotive" reports the death of two well known residents on August 31 and September 1, from violent symptoms "similar to Asiatic cholera."

MINNESOTA.

Kandiyohi County, about one hundred miles west of St. Paul. The annual report of the State Board of Health of Minnesota gives the following facts. Cholera occurred about July 8 in a house occupied by three Norwegian families (about eleven persons). Two of the families had just arrived via New York and Chicago. The first three cases occurred among those just arrived, and were fatal. There were seven cases and five deaths up to July 22.

DAKOTA TERRITORY.

Russian Settlement, on the James River, twenty or thirty miles from Yankton. The "Yankton Union," September 11, reports: "Considerable sickness prevails at present among the Russo-German immigrants (Mennonites) in Yankton, and quite a number, principally children, have died. This sickness is no doubt superinduced by the sea voyage and other inconveniences incident to the journey from Odessa to Dakota." "The Sioux City Journal," September 18, says: "The cholera is raging to a fearful extent among the Russian settlers on the Jim River, twenty or thirty miles from Yankton. . . . . This settlement is made up of Russian emigrants recently from the old country, and no doubt they brought the seeds of this most terrible scourge with them."

Vermilion, Clay County. The "Weekly Republican" reports the death from cholera on September 8 of a man living alone in a filthy log cabin, southeast of Vermilion.

Yankton. Population, 737. "The Sioux City Journal" reports "four unmistakable deaths from cholera" at Yankton, September 15.

UTAH TERRITORY.

Kelton, Box Elder County. Population, 453. The "Corinne Reporter" September 19, 1873, reports that "a sudden and fatal fever is perpetrating its ravages at Kelton, six deaths having already occurred from it. It generally proves fatal the same day of the attack. Considerable alarm prevails, and many people have left the town."

ILLINOIS.

Addieville, Washington County, four miles east of Okawville, on railroad. The "Nashville (Illinois) Journal" reports four fatal cases of cholera at Addieville in the week ending September 20.

Cairo, Alexander County. Population, 6,267. The "Paducah Kentuckian" reports four or five deaths from cholera on June 27.

Carmi, White County. Population, 3,669. "The Weekly Courier" reports the deaths from cholera as follows: July 20, two; 21, one; 22, two; 30, one; 31, six; August 1, one; 2, one; 5, one; and from August 5 to 11, three; total, 18.

Caseyville, St. Clair County. The "Missouri Republican," says: "Up to Sunday evening last (August 3), seventeen fatal cases of cholera had occurred in the little mining town of Caseyville."

Chapin, ten miles west of Jacksonville. on railroad. "The Jacksonville Journal" reports that a well known resident of Chapin died of cholera, August 13, after six hours' illness, and his wife on August 14, after twelve hours' illness.

Chicago. Population, 298,977. The first case of cholera occurred May 24. (See report of B. C. Miller, M. D., Sanitary Superintendent of Chicago.)

Chouteau Slough, Madison County, twelve miles above St. Louis, Mo. The "Alton Telegraph" reports that in one family the father and three sons died of cholera, August 2, and a daughter on August 3, leaving only the mother and one son.

Clearcreek Precinct, Alexander County, near Cairo. Population, 1,068. "The Cairo Bulletin" reports thirty cases of cholera, and twenty deaths at Clearcreek Precinct, from July 10 to 13.

Delhi, Jersey County. The "Missouri Republican" reports six cases of cholera, three of which died August 22, at Delhi. Five of the cases and two of the deaths were in one family.

Exeter, Scott County. "The Jacksonville Journal" reports the following deaths from cholera at Exeter: two on August 6 (one of them died at Riggston the day after leaving Exeter); two on August 7; two on August 8; and up to August 15, between fifteen and twenty in and near Exeter.

Fayette County, twenty-five miles north of Odin. The "Louisville Courier-Journal" reports four deaths from cholera in Fayette County on August 19.

Grafton. The "Missouri Republican," July 16, reports several cases of cholera and two deaths at Grafton, Ill.

Grand Tower, Jackson County. Population, 2,181. On the Mississippi River, west of Makanda. The "Missouri Republican," August 6, reports many cases of cholera at Grand Tower and several deaths, chiefly among the colored folks, in the preceding two weeks.

Jacksonville, Morgan County. Population, 9,203. In a letter to E. Harris, M. D., from David Prince, M.D., November 4, 1873, Dr. Prince gives the following list, obtained from W. H. H. King, M. D., of cases of cholera in Jacksonville. "No. 1, June 28, got well; No. 2, August 8, got well; No. 3, August 10, got well; No. 4, August 13, mother-in-law of No. 3, died; No. 5, August 17, died; No. 6, August 18, died (5 and 6 laid out 4); No. 7, August 19, child of No. 5, died; No. 8, August 19, died (6, 7 and 8 in the same house); No. 9, August 21, died; No. 10, August 22, got well (10 buried 9); No. 11, August 19, got well (went to see corpse of No. 5). These cases all occurred within the space of three hundred feet, except No. 10, who lived half a mile away and was sick at his own house."

Jonesborough, Union County, fifteen miles south of Makanda. Population, 1,108. (See Murphysborough, Ill.)

Lebanon, St. Clair County, fourteen miles east of Caseyville, on railroad. The "Belleville Weekly Democrat" gives the following facts in regard to cholera in and near Lebanon: "On July 4, a man was taken sick with cholera in a harvest field five miles north of Lebanon, and died in a few hours.

Four men from the same field came to a hotel in Lebanon the same evening; one of them died that night and another one the next day, and the remaining two took the train for St. Louis. The week ending July 14 there were several cases of cholera, some of which were fatal. Week ending July 21, still some sickness, but not so many deaths from cholera." Week ending August 9, "The number of deaths exceeded that of any previous week this summer." Among the deaths were three children in one family." Week ending August 23, "Still some sickness." Of the family above-mentioned, the fourth and only remaining child died.

Litchfield, Montgomery County, thirty miles east of Delhi. Population, 3,852. The "Union Monitor" gives thirty deaths for August, of which twenty were from cholera morbus and cholera infantum. The "Missouri Republican," September 2, reports a number of cases of cholera at Litchfield on August 30; in one family, three cases and one death. The "Union Monitor," September 17: "The health of the town has not been good, and there are numerous convalescents even now, but no grave cases of illness."

Makanda, Jackson County. Population, 1,680. The "Alton Telegraph," August 14, reports that a family of three persons, who had left Indiana to avoid the scourge, died of cholera, after twelve hours' sickness, in a neighborhood ten or twelve miles east of Makanda. "Four or five relatives, who came to their assistance, in a few hours were taken down and soon died."

Murphysborough, Jackson County, fifteen miles northwest from Makanda. Population, 3,464. A correspondent reports: "Cairo, September 6. Parties direct from Murphysborough, Jackson County, report eight deaths there on Thursday (September 4) from cholera, and eight new cases yesterday. Five members of a family . . . . near Jonesborough, Union County, died from the same disease."

Nebo, Pike County, sixteen miles east of Louisiana, Mo. A correspondent reports: "Twenty deaths have occurred in the region round about Nebo, Pike County, within the past month. In the family of . . . . one mile west of Nebo, four persons have died.

Odin, Marion County. Population 1,268. The "Missouri Republican" reports that up to September 4, eighteen deaths from cholera had occurred at Odin.

Okawville, Washington County. Population of the whole township, 1,521. The "Nashville (Ill.) Journal" reports eighteen deaths from cholera at Okawville from August 17 to September 3. The "Missouri Republican" reports five deaths on September 11, and three on September 12 from cholera, at Okawville.

Whitehall, Greene County, twenty-eight miles above Delhi, on railroad. Population, 1,200. The "Indianapolis Journal," July 12, 1873, reports cholera prevailing at Whitehall, Greene County, Ill.

INDIANA.

Aurora, Dearborn County. Population, 3,304. The "Independent": "There has been but one death from cholera here since our last issue, viz.: . . . . who died on Monday (August 11), which makes eleven deaths in all within the last four weeks, who have died from well-authenticated attacks of that disease."

Cochran, two miles west of Aurora, on railroad. Population, 675. The "Aurora Independent," July 17, reports "quite a number of cases of flux, and some of cholera morbus," at Cochran; and on August 7, "quite a number of cases of flux."

Cumberland, Marion County, eleven miles east of Indianapolis, on railroad. Population, 276. The "Chicago Times," September 20, 1873: "Over twenty deaths from cholera have occurred at Cumberland and in that vicinity within the last three weeks, largely among the Germans."

Delaware. The "Evansville Journal" reports two deaths from cholera, August 2, at a little hamlet called Delaware.

Evansville, Vanderburgh County. Population, 21,830. The "Daily Journal," June 4, reports a death from cholera morbus. The "Journal," June 23, says thirteen cases of cholera had been reported to the Health Officer in the preceding week. The "Louisville Courier-Journal" states that seven of the thirteen cases above mentioned proved fatal. The "Journal," July 1, says twelve cases of cholera had been reported in the preceding week. The "Journal," July 8, says nine cases of cholera had been reported the preceding week, and that twelve deaths from cholera had occurred in the month of June. The "Journal," July 21, reports three deaths from cholera on July 19, and six in week ending July 19. The same paper, of August 2, reports two; and August 12, three more deaths from cholera.

Indianapolis, Marion County. Population, 48,244. The "Daily Journal," August 15, 1873, says: "According to the record of the Board of Health, the total number of deaths by cholera from the date of its appearance, July 25, to August 11, was thirty-three." Three deaths from cholera occurred August 14, 15, and 17.

Jeffersonville, Clarke County, opposite Louisville, Ky. Population, 7,254. The "Courier-Journal," June 22, reports several severe cases of cholera morbus, and July 2, six cases of cholera.

Lafayette, Tippecanoe County, sixty-four miles northwest from Indianapolis, on the railroad. The "Chicago Times," of August 27, reports that "several cases of *flux* have proven fatal" at Lafayette, Ind.

Mount Vernon, Posey County. Population, 2,880. The "Weekly Republican," of August 7, says: "We subjoin a list of the victims of cholera in this city, classified by date, which embraces every fatal case which occurred in the city from the first (June 7) to the last (August 5), a period of eight weeks and three days." The dates are as follows: —

Deaths from Cholera at Mount Vernon, Ind., in 1873.

Date.	Number of Deaths.	Date.	Number of Deaths.	Date.	Number of Deaths.
June 7	1	July 13	2	July 25	4
15	2	14	4	27	2
20	1	15	3	28	1
22	1	16	6	29	1
27	1	17	4	30	1
28	3	18	3	31	1
30	1	19	3	Aug. 1	1
July 1	1	20	3	2	1
8	1	21	3	3	1
9	2	22	2	4	2
11	6	23	3	5	1
12	6	24	1	Unknown	1
				Total . . .	80

The "Republican," August 14, reports three deaths from cholera in the week ending August 14.

New Albany, Floyd County, opposite Louisville, Ky. Population, 15,396. The "Courier-Journal" reports several cases of cholera morbus, sporadic cholera, and cholera, at New Albany, from June 23 to July 4.

Newburg, Warrick County, ten miles above Evansville, on the Ohio river. Population, 1,464. The "Evansville Journal," June 19, 1873, reports two cases of cholera morbus at this place.

New Elizabeth, Hendricks County. The "Indianapolis Journal," September 6, 1873, reports twelve deaths from cholera at New Elizabeth in the preceding ten days. On September 13 the disease is reported as still prevailing. The "Indianapolis Sentinel" gives a list of names of the fatal cases of cholera that occurred at New Elizabeth. The list gives twenty-four names, and contains a father and two daughters; a mother and child; a husband and wife; a father, son, and daughter; a father and three children, and a husband, wife, and child.

North Vernon, Jennings County, forty-nine miles west of Aurora. Population, 1,758. The "Weekly Sun," July 16, says: "There are several cases of cholera morbus now in town, and one or two cases of genuine American cholera."

Near Princeton, Gibson County. Population, 1,847. Twenty-seven miles

north of Evansville, on railroad. The "Princeton Weekly Democrat" reports that from July 18 to August 2, thirteen deaths from cholera occurred about three miles from Princeton, upon what is known as Indian Creek." This number contained a husband, wife, and five children, and a mother and two children. Three other children of the last-mentioned family were reported sick. The "Democrat" also reports one death from cholera in Princeton the week ending July 19.

Terre Haute, Vigo County. Population, 16,103. The "Daily Journal" reports a death from cholera morbus July 28, and another August 8. The wife of the patient who died July 28 died on August 9, and is said to have "suffered an attack of cholera, but recovered, and died at the hospital of some other disease."

Washington, Daviess County. Population, 2,109. The "Weekly Age" reports deaths from cholera in Washington, as follows: Week ending August 15, one; September 5, four; September 12, two.

OHIO.

Burlington, Lawrence County. The Catlettsburg, Ky., "Herald," July 8, 1873, states: "Two or three deaths are reported at Huntington (West Va.), and five at Burlington, Ohio, with cholera morbus."

Cadiz Junction, Harrison County, sixty-eight miles west of Pittsburg, Penn., on railroad. (See Pittsburg, Penn.)

Cincinnati, Hamilton County. Population, 216,239. The first reported death from cholera took place June 14. (See Report of J. J. Quinn, M. D., Health Officer.)

Cleveland, Cuyahoga County. Population, 92,829. The "Plaindealer" reports five cases of cholera from July 15 to 18, some of them fatal.

Columbus, Franklin County. Population, 31,274. The "Daily Journal" reports the following deaths from cholera in Columbus: From July 5 to August 7, eighteen deaths (out of twenty-four cases), and from August 7 to 14, eight deaths. The above mentioned cases and deaths occurred outside of the penitentiary. In the penitentiary, from July 12 to August 1, there were twenty deaths from cholera, and one in the week ending August 15.

Dayton, Montgomery County. Population, 30,473. Thomas L. Neal, M. D., Health Officer, in a letter to J. C. Peters, M. D., gives the following table compiled from reports made to the Health Officer: —

Deaths from Choleraic Diseases in Dayton, O., in 1873.

Date.	Duration of Disease.	Sex.	Age.	Form of Disease.
June 22	2 days	Male	9 days	Cholera Morbus.
July 1	30 hours	Male	35 years	Cholera.
4	18 hours	Male	35 years	Cholera Sporadica.
14	4 days	Female	45 years	Cholera Morbus.
19	7 hours	Male	38 years	Cholera Asiatica.
22	12 hours	Female	49 years	Cholera Sporadica.
22	2 days	Female	49 years	Cholera Morbus.
26	12 hours	Female	36 years	Cholera Sporadica.
26	3 days	Male	81 years	Cholera Sporadica.
27	3 days	Female	16 years	Cholera Sporadica.

Portsmouth, Scioto County. Population, 10,592. In a letter to E. Harris, M. D., M. S. Pixley, M. D., August 13, 1873, reports the following cases of cholera: "(1) Colored fireman on local packet to Cincinnati, taken sick on the boat and died June 15, six hours after arrival at Portsmouth; (2) a gentleman from Mount Vernon, Ind., who was flying from the cholera, died twenty-four hours after his arrival at Portsmouth: (3) an intemperate beer-seller; (4) a little child. The result of the two last mentioned is not stated."

Springfield, Clark County. Population, 12,652. The "Daily Republican" reports two sudden deaths from cholera on August 9 and 11.

Steubenville, Jefferson County, forty-three miles west of Pittsburg, Penn. Population, 8,107. The "Louisville Courier-Journal," June 19, reports the death from cholera at Steubenville, of a man who had left Cincinnati the day before.

WEST VIRGINIA.

Huntington, Cabell County. (See Burlington, Ohio.)

Wheeling, Ohio County. Population, 19,280. The first case of cholera occurred June 9. (See the Report of Dr. S. L. Jepson, Health Officer.)

VIRGINIA.

Abingdon, Washington County. Population, 715. The "Abingdon Virginian" of June 27, 1873, reports "several violent cases of cholera morbus" about June 13, one of which was fatal.

Gish's Mills, Roanoke County (on railroad from East Tennessee). The "Lynchburg Daily Virginian" of August 21, 1873, reports four cases of cholera among negroes at Gish's Mills, two of them fatal.

PENNSYLVANIA.

Philadelphia. The "New York Times," July 16, 1873: "Philadelphia, July 15. — There are many cases of what is called by the physicians sporadic cholera in the up town sections of the city, especially in the densely populated districts. It is particularly bad in the Eighteenth and Nineteenth wards, and the disease seems on the increase."

Pittsburg, Alleghany County. Population, 86,076. A letter to E. Harris, M. D., from W. Snively, M. D., Physician to the Board of Health, reports the following facts: On August 4, a woman died of cholera after an illness of seventy-two hours. On August 6, her husband died of the same disease after being sick forty-six hours. They lived about five hundred yards beyond the city line, and the wife was taken sick two days after their return from Cadiz Junction, Ohio, a railroad village about seventy miles west from Pittsburg. The man stated that "there were several deaths within a few hundred yards of where they were boarding in Cadiz Junction, which were very sudden, and that he was told it was cholera morbus." On August 6, a woman living just within the city line, and about five hundred yards from the residence of the preceding cases, died of cholera after twenty-four hours' illness. She was present at the death of the first mentioned case and performed various duties. On August 10, a fourth fatal case of cholera occurred in the person of a man who had assisted in burning the bedding of the first cases.

In the preparation of the preceding notes I have been indebted to George P. Rowell, Esq., of New York, for the use of an immense file of daily and weekly newspapers from all parts of the country.

I have also received constant and valuable assistance from Ely McClellan, M. D., Assistant Surgeon, U. S. Army, and from Drs. E. Harris and J. C. Peters, of New York.

CHOLERA IN CHATTANOOGA, TENN., AND CITIES SOUTH OF NASHVILLE, DURING THE SUMMER OF 1873.

By J. H. VAN DEMAN, M. D., of Chattanooga.

During the latter part of May, 1873, the cholera first appeared in Nashville, Tennessee, and raged there with great violence, until about the first of July, when its decline commenced, and a few days more numbered it amongst the things that were, in that city. Previous to its disappearance there the first case was noted in Chattanooga, Tenn., one hundred and fifty-one miles south of Nashville, and was that of a brakeman, running upon the Nashville and Chattanooga Railroad. Before leaving Nashville he had frequent attacks of diarrhœa, and the *very day of his departure* was seized with that peculiar painless diarrhœa; he, however, came on his train to this point, was taken with vomiting and purging, rice-water discharges, in fine, with all the symptoms of cholera well defined. Collapse set in, and in a very few hours he was ready for his coffin.

Several other cases of a similar nature appeared within the next twenty-four or forty-eight hours, and all among the employées of that road, or the Alabama or Chattanooga Railroad, every patient either having left Nashville, Tenn., or Birmingham, Ala., where the disease was then raging, with cholera symptoms, or had been exposed to the infection *while there.* Our next case was a Mrs. Richards, the proprietress of a boarding-house, where most of the railroad employées connected with these different railroads were in the habit of stopping when in the city. This patient had a well marked attack of cholera, and the violence of the same was so great that she lived but a few hours. From these cases, it spread rapidly, first among the railroad men, then in the immediate neighborhood of their boarding-house, and very soon we discovered the disease, well discernible all over the city, being felt slightly upon the hilly parts of the city, but very severely in the lower, flat, and marshy regions. Indeed, I might say without fear of contradiction, that nine tenths of all persons here, who were attacked with cholera, either lived in these marshy and low grounds, or else transacted business there during the day, and came home only at night to procure their natural rest, and the most fatal of all these cases enumerated was in the limestone formations, where it cropped out close to the surface. The disease also "lay in wait," so to speak, for our poverty-stricken, the destitute, where squalor, filth, and dissipation did most abound, though a few of our very best citizens succumbed to the scourge.

The first case of cholera that appeared in this city, was upon the 23d of June, 1873, and rapidly spreading over the different wards, until July 4,

when it apparently had reached its acme, then gradually subsiding until July 16, when it disappeared for about one month, and then returning for a few days, more fatal than before, it left the city, may we hope, never to return.

Our mortality for the first few days was greater among the white than the colored population, males more than females, and adults more than children; but soon it changed its base, and the poor ignorant negroes suffered terribly, probably owing to their diet, their peculiar habits of cooking, their filth and utter disregard of cleanliness (as a class), etc.

In proportion to those attacked the mortality was about one in five, and while the population of our city, at the outbreak of the disease, was supposed to be about twelve thousand inhabitants, now, during its visitation, we lost *from all causes*, about one in seventy, by cholera alone one in every two hundred, and when we consider that our whole number of deaths from all sources, *during the same period of time*, in 1872, was only forty-three, while this year it footed up one hundred and seventy, this difference then being justly charged to "cholera account," we see our death rate becomes a fraction over one in every one hundred of our entire population. During the progress of the epidemic, about two thousand of our population left the city, for what they supposed were more healthy locations; but of that number who "refugeed," seventeen died from that which was reported to us as cholera, showing that they must have had the germs of the disease in their system when they left, and that their mortality was at least as great as, if not greater than, that of those who remained at home among their friends and nurses, took care of their persons, lived carefully, washed cleanly, ate sparingly, and were governed by the advice of their physicians, whose services could be procured when needed.

We have heretofore stated that the mortality was greater, among the inhabitants of the lower and marshy portions of the ciry, and when we state that fully one half of our people live upon the hills, and that only five (5) deaths are reported from among them, and all the rest are designated as having lived in the low lands of the city, the statement becomes still more apparent.

Again, an indiscriminate use of vegetables during its visitation here, paved the way very plainly for its attack, — the free use of them and fruits being almost equivalent to certain death, while those who abstained from their use entirely, either were not attacked at all, or if they were, recovered with but little medication. During the epidemic our local authorities prohibited their *sale*, and *recommended* that no one should even use them, and this being seconded by the entire medical faculty, their order and recommendation was very generally observed. In proof of this statement, we would cite the following facts: On the last days of June the daily death-rates dropped down to a point where we were consoling ourselves that the pestilence was about to leave us. By some means the fruit and vegetable gardeners found out that the sales of their products were to be stopped, and at once they almost gave them away. The effects of which were seen immediately by the mortality reaching its acme upon the 4th of July — being directly attributable to

the free use of their vegetables and fruits. *Second.* On the 16th of July, the last case of cholera was seen in the city, and on the 20th, the embargo on fruits and vegetables was raised. About the 1st of August, 1873, cholera again reappeared and raged with *great severity* (within very narrow limits), for a few days. This attack could be traced directly to the intemperate use of unsound water-melons and fruits, occurring as it did almost exclusively among the negroes and a miserable class of whites, but little superior to the negro. And this last attack of cholera did not cease until the embargo was again laid upon all fruits and vegetables, when it promptly yielded.

During the past two years, as health officer of this city, I have kept a complete record of all deaths that have occurred, with the cause of the same; and during this epidemic an official copy of said record of the day before was published by our daily press, which being published every morning, did much to quiet the excited public, calming the fear of the timid, nerving the hopeful, and at once "bringing to grief" those old croakers who are always ready and more than willing to magnify statements to the injury and detriment of not only the public, but also of their own shortsighted and narrow minds.

Nearly every town between Nashville and this place suffered more or less from cholera during its visitation to the former place, except Stevenson, Ala. (where no one sick was allowed to be put off the train), and fortunately for them all, it subsided there simultaneously with its decline at Nashville, spending its whole force upon *our city* after its disappearance there — the same thing existing in all the towns south of us, the cholera disappearing *with them* at the same time as it did with us.

In Nashville, the prevalence of cholera among the soldiers on duty, is an item of note. Upon its introduction into that city, Dr. D. G. Caldwell, the surgeon in charge, advised the removal of the troops to some high point, far distant from the city, which was accordingly done; and having pitched their camp some eleven miles distant on a beautiful grassy knoll, near splendid waters, and considerably elevated above the surrounding country, he proceeded to quarantine them there, endeavoring to protect them from all outsiders; and strict guards being set, no one was allowed to return *to* the city, and if from any cause whatsoever the order was disobeyed, the one violating it was not allowed to return to camp. Strict sanitary rules and regulations were laid down and enforced, and the result was just what we would foresee; that not a single case of cholera appeared from that day in the camp, while of the few who remained in garrison at Nashville, most of them were attacked, and some of them with fatal results. In regard to the sanitary condition of this city, at the *onset* of the scourge, I have but little to say; but then, our local authorities aroused themselves and took very active measures to have every place put in the very best sanitary condition possible. Human excrementitious matter was either at once buried or disinfected. Local cleansing, and the disinfection of almost every part of the city was resorted to and enforced by especial sanitary police; lime, carbolic acid, sulphate of iron (commercial), etc., etc., were freely used, and to their especial use, and the untiring energies of our mayor and a few of our Council who remained in

the city unawed by the danger everywhere around them, to them and the entire medical faculty, their aid and instruction freely given at all hours, and the truth *published every morning* of the mortality the day before, we owe the rapid decline of the disease in this city.

From Chattanooga it spread along the line of our railroads, proving fatal in about the same proportion of cases as here (except in those towns where trains were not allowed to stop, and in such places no one was attacked). Knoxville, Jonesborough, and Greeneville, in East Tennessee, suffered more or less from the pestilence, and in proportion to their sanitary condition, so their mortality record shows. In the latter place the mortality was fearful; at least one half of the citizens there having contracted the disease, and their ratio of deaths about the same as in other places, — fully one in every five, and all owing to their wretched sanitary condition. A large spring, from which most of her citizens drew their supply of water, having been contaminated by poisonous matter being thrown upon the hills contiguous thereto, which after the first shower destroyed the purity of its flow.

In Birmingham, Alabama, at a height of six hundred and fifty feet above the level of the sea, with a clear, compact, and yellow clay soil, underlaid in some places with shales of limestone, the mortality was the most fearful of any one city in the South. The first case appeared there about the first of June, 1873, shortly after its appearance in Nashville, and being upon the line of the North and South Railroad, one of the links of the great southern chain leading from Louisville *through Nashville* to the South, the cause of the disease, or rather the locality from whence it came, was perfectly clear. Here, its course was very singular. From the date mentioned, only one case appearing every five days until the 21st of June, then one every day for seven days, and from three to ten every day for the next fourteen days, when it suddenly disappeared, at about the same time of its subsidence in Chattanooga; and whilst it did not seem to be so very contagious then, it was plain to be seen that it culled its victims from the low and filthy portions of the place, where poverty and squalid wretchedness prevailed, and where the free use of limestone-water was indulged in by the people; and whilst the moderate use of vegetables did not seem detrimental, still it was noted that those who used them indiscriminately suffered most when attacked. The mortality was here, as is usual in other places in the South, greater among the colored citizens than the whites; among males than females; amongst adults than children; greater where sanitary rules were disobeyed than among those who adhered to them strictly. The whole number of deaths *from all causes* in this city was, from June 1 to July 18 (from its outset to its subsidence), one hundred and seventy-five, while cholera claimed one hundred and thirty of that number, and this, too, in a population of less than four thousand inhabitants, when all were at home; but as all but five or six hundred had left the place for more healthy climes, the mortality is fearful to contemplate.

CHOLERA IN LITTLE ROCK, ARKANSAS.

REPORT BY THE BOARD OF HEALTH.

THE first case of cholera — recognized as such — occurred in this city on the 5th day of July last, and ended fatally on the following day.

Little Rock is situated on the south bank of the Arkansas River, about three hundred miles (by water) from its confluence with the Mississippi, and contains a population of about twenty thousand. The city is in direct communication with St. Louis, Mo., by means of the recently constructed Cairo and Fulton Railroad; with Memphis, Tenn., by way of the Arkansas River and the Memphis and Little Rock Railroad.

Cholera prevailed in Memphis for ten days or two weeks before the first case was noticed in Little Rock, and was reported in New Orleans and at other points along the Mississippi River several weeks before. Several cases of cholera were reported among railroad hands, at work on the Cairo and Fulton Railroad, some fifty miles north of this city. These cases last mentioned occurred only a few days before the first case was recognized in Little Rock.

The first case of cholera reported in this city — which rapidly ended in death — occurred as before stated, on the fifth day of July, in the most elevated and salubrious portion of the city, known to the citizens of Little Rock as "Capitol Hill." The victim in this case was that of a woman who had been recently confined, and had no communication whatever with persons coming from infected localities, that could be ascertained. It is proper to add, with reference to this case, that the patient had in the same day that she was seized with the disease, eaten largely of "apple dumplings."

The second case, which occurred the next day (July 6), and which was likewise fatal, took place in a locality, which, in a hygienic point of view, was far less favorable than that under which the first case was observed. The house in which the patient was found, stood in a low and damp situation, and almost immediately over a large uncovered sewer. This case was that of a man, who, but a few days before was at work on a railroad embankment of the Cairo and Fulton Railroad, fifty miles north of Little Rock. Feeling unwell he quit work, and shortly after came to this city, when he was almost immediately seized with the disease, and died of it in a few hours after.

These two cases of deaths from cholera were perhaps the only ones which took place in the city proper, and probably no other well marked case was observed by any physician, but a large number of cases of cholerine and cholera morbus were reported and treated in all portions of the city.

About the same day as that upon which the last case took place (Jul ,

6), the steamer *Fort Gibson* from Memphis, Tennessee, came into port, having on board a negro suffering with cholera, and in an almost moribund condition. This patient was taken to what is known as the "County Poor House," where he died in a very few hours after.

This poor-house is a miserable establishment, composed of five poorly constructed wooden houses, which have for the past ten or twelve years been used for hospital purposes. These buildings are situated in the western suburbs of the city, beyond "Capitol Hill," about three hundred or four hundred yards distant from the house in which the first case of cholera appeared. The inmates of this institution, which is of itself a disgrace to civilization, are composed for the most part of inebriates, debauchees, vagrants, negroes, railroad hands, emigrants, and the poorest-fed and worst clothed portion of our population. The sanitary condition of the poor-house up to the time of the outbreak of the disease, was as bad as could well be imagined; the floors were filthy, the clothing, bedclothing, and inmates themselves covered with vermin. The food upon which they were fed, was notoriously improper and unhealthy.

After the introduction of the case from Memphis, about seven cases took place in rapid succession, all of which proved fatal. A number of cases of cholerine were also treated.

Much credit is due to the kind and humane medical attendant, who upon the invasion of the disease exerted himself to the utmost to improve the sanitary condition of the entire premises, and to protect, if possible, the unfortunate inmates against this fell disease. The diet was at once improved, the walls of the wards well whitewashed, the floors scoured, mopped with a strong solution of carbolic acid, and then sprinkled with lime. Saucers containing chloride of lime were placed in the several wards. The stools of *every* patient were disinfected, thrown into pits, and covered over with earth. The attending physician visited daily the patients, instructing each, that in case the least laxity of the bowels should be experienced, to at once take to his bed and apply for medicine. In a few days after these measures were adopted, all appearances of cholera disappeared from our midst.

Almost simultaneously with the outbreak of the disease in the poor-house, it made its appearance among the convicts confined in the State Penitentiary. The hygienic condition of this institution was far better than that of the poor-house, but it was ascertained that the contractors of the penitentiary had only a few days previous to the appearance of the disease, purchased at auction a quantity of spoiled beef, and that the convicts were being fed upon it. The physician of the penitentiary was at once informed of this fact, who at once corrected the evil, and by adopting a sanitary regimen, not unlike that employed at the poor-house, the cholera ceased to exist. Five or six deaths were reported as having taken place at the penitentiary. All the cases that occurred were fatal.

We would also state that for several weeks prior to the advent of cholera in Little Rock, the Board of Health had been actively engaged in improving the sanitary condition of the whole city. Little Rock being very defective in sewerage, a large number of scavengers, with carts, were em-

ployed in cleaning up and carting off filth and garbage from the streets and alleys. These measures were continued up to the time of the appearance of the first case, when these operations were suspended, and the carting of offensive matters through the streets prohibited. Disinfectants, however, were copiously used upon everything which emitted an unpleasant odor. Cards from the Board of Health were published in the daily papers, instructing the people in the kinds and the methods of using disinfectants. In addition to these measures, sanitary policemen, under instructions of the Board of Health, visited every house in the city, notifying the owners or inmates thereof, to disinfect their privies and premises generally.

[APPENDED STATEMENT.]

LITTLE ROCK, ARK., *September* 27, 1873.

ELISHA HARRIS, M. D., *Secretary, etc.*: —

SIR, — Your letter of the 2d inst., making inquiry as to the prevalence of cholera on the Perkins plantation, is at hand. I submit the following, which I know to be the main facts in the case. I make this much haste because I see you are in some hurry to have your report ready at an early date.

The Perkins plantation is situated on the south bank of the Arkansas River, about sixteen miles below Little Rock. It is on the average level of the Arkansas bottom and, without levees, the larger portion of it would be subject to overflow in high water.

The soil is principally sandy alluvial deposit with portions of black clay ("buckshot land"). The "Quarter" is situated immediately on the bank of the river. This is a collection of about a dozen cabins, composed of logs and boards thrown loosely together as if by hap-hazard. These have been occupied for a number of years by the average class of plantation negroes, a notoriously filthy and improvident set of beings, and the houses with their surroundings present about as inviting a prospect to infectious germs that seek pabulum whereon to feed as can well be imagined. The houses are not arranged with any regularity, and the whole area of the quarter (about five acres) is covered with the most luxuriant growth of Jamestown, careless, and other weeds, with only foot-paths leading from house to house.

About seventy-five souls have an existence in this "quarter," who are far from being supplied with the necessaries of life, and while being scantily and filthily clad are forced to subsist on short rations of bacon and bread, and as they fail to provide themselves with gardens of wholesome vegetables, when the season for such things arrives their cravings urge them to appropriate largely of unripe and unwholesome fruits, green corn and other vegetables alike unwholesome.

This plantation has residing in it, aside from the residents in the "quarter," about a dozen other families, in houses remote from each other, none of the members of which families suffered from cholera.

It is appropriate to state in the beginning that the residents of this "quarter" had been confined closely to their crops for a number of weeks pre-

vious to the outbreak of the disease, and it could not be ascertained that any new-comer had appeared on the place for at least several weeks previous to this outbreak.

The first case occurred on the night of the 24th of July, in the person of a young woman who was noted among the people for her irregular habits as to diet and inordinate use of fruits green and ripe, and it appears from information that on the day previous to this seizure she ate largely of unripe peaches against the remonstrances of her friends. Such being the case, had the disease stopped here this would have been regarded by Dr. Reynolds (the physician who attended her) as a grave case of *cholera morbus*, but on the next day two other cases appeared, one in a boy aged about twelve years, and one in a man aged about forty years, both passing rapidly into the stage of collapse, and the case in the boy terminating fatally in less than twenty-four hours, though the man lived over forty-eight hours. These were followed in quick succession during the next two days by seven (7) other cases (ten in all), terminating fatally with all the recognized symptoms of cholera, to say nothing of two or three milder cases, and many cases of *cholerine* which received prompt attention and, it is believed, were prevented becoming cases of *fatal cholera.*

The last case occurred on the night of the 27th, and the last death on the evening of the 28th.

We are informed that one case occurred on the Pennington plantation, one mile below the Perkins plantation, on the 29th.

It is worthy of note that in 1866, cholera alighted on both these plantations and committed great havoc, though other places along the river suffered in like manner.

Another point may be worthy of mention. Those who died on the Perkins plantation in 1866, were *buried on the bank of the river above the "quarter,"* and the rise in the river last spring *carried away these graves, and the bodies either floated down the river, or were taken from an eddy just above the "quarter"* and reinterred; while probably some remained buried in the sand at the bottom of the river. The water used by the inhabitants of the "quarter," at and before the outbreak of the cholera, was obtained from the river opposite the "quarter." The use of this water was discontinued.

All of which is hastily submitted by yours, very truly,

D. H. DUNGAN, M. D.

CHOLERA AS IT PREVAILED IN CHICAGO, ILL., IN 1873.

By B. C. MILLER, M. D.,

Sanitary Superintendent of Chicago.

During the summer of 1873, Chicago was visited, in common with many places in the west and south, by this disease.

It is true that sanitary science and care has rid this, the most terrible of diseases, of many of its terrors. It is a well known fact that good water, perfect drainage, and personal attention to cleanliness and diet, with proper care has rendered this disease, to a certain extent, controllable. During the epidemic of last summer, the disease struck hardest where sanitary laws were not observed. When the first cases occurred here, the department went to work quietly, and did what could be done, and the result will show for itself.

The cases of cholera occurring in and about Chicago during the last summer, were principally in the Fifth Ward, south of Thirty-seventh Street and west of State Street, and in the adjoining town of Lake, which is a continuation of this district, being separated from the city by Thirty-ninth Street.

The district is densely populated, principally by foreigners, consisting of Germans, Swedes, and Poles; the families living in small rooms poorly ventilated, and subjected at all times to the ill effects of overcrowding. The district is low, with sandy soil and poor surface drainage. The water used, at the time of the first case, was procured from shallow wells, supplied with surface water, ordinarily from five to sixteen feet in depth, and walled up with pine boards, the water rising to within about two feet of the surface of the ground.

Many cases occurring in the beginning and, in fact, throughout the continuance of the disease, were reported as cholera morbus, as many physicians were loath to acknowledge the disease as cholera. Many cases so reported, were identical with the cases reported as cholera.

There were, outside of this district, thirteen cases reported as deaths from cholera, in different parts of the city, the most of them from two to four miles from the district in which the first cases occurred, and with one exception in locations where overcrowding and filth were prevalent.

There were six cases in the Fifteenth Ward, two in the Third Ward, one in the Eighth, three in the Sixth, one in the Thirteenth, and one in the Twelfth Ward. After the disease broke out in the Fifth Ward, many persons fled to other parts of the city; however, no connection could be traced between the cases in the Fifth Ward and the cases in the wards mentioned above.

The first case occurred on May 24, at No. 444 Arnold Street, in the person of John McFee, a bridge builder, who had been working near Memphis, and left on account of the cholera. When he arrived in Chicago he had diarrhœa, which remained unchecked, and after a week or ten days developed choleraic symptoms, and proved fatal.

The second case was at No. 945 Butterfield Street, on June 10, two miles from the first case, in a tenement house occupied by several Danish families. This family had moved from Arnold Street, near Fortieth Street. No connection could be established between this and the first case. After an illness of twelve hours, the patient died.

The third and fourth cases occurred at the same place, and in the same family, on June 12 and 14, both proving fatal after an illness of ten and twelve hours respectively.

The fifth case at the same number, July 25, — sick nine hours.

The sixth case occurred at No. 922 Butterfield Street, almost directly across the street. This person was the wife of the fifth case, and had lived at No. 945 Butterfield Street, and had assisted in nursing the patient at that place.

The seventh case occurred on Arnold Street, between Thirty-eighth and Thirty-ninth streets, in a woman who had nursed the patient at No. 922 Butterfield Street.

The eighth case was on Wentworth Avenue, near the corner of Fortieth Street, a person who had nursed the woman on Arnold Street.

The ninth case was at the corner of Arnold and Forty-first streets. The connection between this case and the last, was the same as in the others. The house in which the case occurred was on the west side of the street, and the stools of the patient were thrown out in the middle of the street.

The tenth case was directly opposite on the east side of the street. From this point the disease spread over the southern portion of the district. Other cases occurred in the immediate vicinity of Nos. 945 and 922 Butterfield Street, and from this point the disease progressed southward on Butterfield and South Dearborn streets.

From the beginning, active measures were taken by the officers of the Board of Health, Drs. Rauch and Reid. Thorough disinfection was prosecuted, and the people warned not to use the water from surface wells. The Board of Health recommended that water pipes be laid so that the district could be supplied with pure lake water, and ordered the wells to be fouled with carbolic acid, so that the water could not be used for drinking or culinary purposes.

The Board of Public Works supplied the district with water as far south as Thirty-ninth Street, where public hydrants were placed by this Board for the benefit of the people in the town of Lake. Butterfield Street was supplied June 24; Burnside Street on July 13, and Arnold Street June 10 to 21.

August 10, upon the retirement of Dr. Rauch, I was appointed Sanitary Superintendent, and visited the district for the first time in company with Dr. Simons, a physician residing in that district, and visited some ten or twelve cases.

Dr. Simons was appointed a special Sanitary Inspector, with directions to superintend the enforcement of needed sanitary measures in that district, especially in the matter of daily disinfection, which was rigidly enforced on all premises.

The Cholera Hospital was opened for patients, and all cases in boarding or tenement houses immediately taken there. All cases of premonitory diarrhœa which could be found were promptly cared for. There were twenty-one cases admitted to the hospital, many of whom were in the stage of collapse; these invariably died. Of those removed early in the disease a large percentage recovered. Of the whole number admitted eleven died and ten recovered. The active measures used, and thorough disinfection throughout the city, and especially supplying the infected district with pure lake water and the establishment of a home, under a competent person, where all children were sent from infected houses, bathed, properly clothed, and a good diet given, had a marked effect. Of the children so cared for but one case occurred, and that did not prove fatal; while in families where the disease prevailed before the establishment of the home, the children were fully as subject to the disease as the adults. This isolation, with the other measures used, seemed after a time to control the disease. The cases that occurred here were evidently similar to the cases occurring at Evansville and Mt. Vernon, Ind., and Nashville, Tenn.

On September 8, John Sheer was attacked with the disease on his arrival in this city, he having just come from Evansville, Ind. His case presented all the symptoms, and was in every respect similar to the cases that occurred here; the case terminated fatally after an illness of one day. After this time no cases occurred in the city.

The first case, as stated above, came from Memphis; the next three had resided in the city for some time; the fourth case was an immigrant, who had been in the country two weeks, and in the house (No. 945 Butterfield Street) one week. He had been feeling ill for a day or two, and took a dose of cathartic medicine; after this he was taken with purging and vomiting, and died in nine hours; after this, all the cases occurring here, were in the persons of residents, with the exception of eight or ten immigrants, who had been in the city from two days to two weeks.

The effect of cleanliness on families and individual cases was marked. Those who observed sanitary laws, attended to the disinfection of stools, and who were prompt in calling a physician, with few exceptions recovered, and the occurrence of a second case in such families was rare. On the other hand, when the stools were not cared for, and the vomit permitted to remain on the floor, and the bedding (principally feather beds) used without having been properly cleaned, and where no attention was paid to ventilation or personal cleanliness, several cases would generally occur, and as a rule, prove fatal.

As but few cases were reported to the Board, until they had proved fatal, we had no data, aside from the Cholera Hospital, by which to form an estimate of the value of any plan of treatment.

Dr. Simons, Special Inspector, who had charge of the district and hospital, reports that no treatment was preëminently successful.

First. The antizymotic (sulphurous acid) was perhaps the most satisfactory.

Second. Anodyne hypodermic injections and Squibb's mixture.

Third. Alteratives, calomel, etc.

Of the cases neglected in the beginning, fifty per cent. died under all treatment; of the cases taken early in the premonitory diarrhœa before vomiting had occurred, ninety per cent. were saved.

NOTE UPON THE RESULTS OF MICROSCOPIC EXAMINATION OF THE CHOLERAIC DISCHARGES.

By J. N. Danforth, M. D., *of Chicago.*

Specimen No. 1. — A great amount of granular matter was present, in the form of very large oblong masses, of a light gray or ash color. On being gently compressed by the covering glass, these masses separate into smaller masses, and, if the pressure be still increased, these secondary masses are separable into very minute granules, which are probably composed of albuminous matter, derived from the blood. I also observed occasional oblong patches of small round or polygonal cells, probably epithelial cells, thrown off from the villi and floor of the intestinal canal; and, scattered here and there, an occasional full grown epithelial cell, not yet carried out of the intestine, but looking cloudy and nebulous, as though it had been for some time macerated in the intestinal contents. Specimen No. 2. — About the same appearances, with the addition of a few free oil globules. Specimen No. 3. The sediment consists largely of globules and floating masses of granular matter; an occasional patch of aborted epithelial cells may be seen, but they are less abundant than in preceding specimens. Specimens Nos. 4 to 11. — The appearances are chiefly marked by the presence of extraneous matter, derived from the beef tea, of which the patient partook frequently during the last hours of his life. I find shreds of striated muscular fibre; bits of connective tissue; crystals of sodium chloride and potassium chloride; fat globules; a few epithelial cells; masses of granular matter; bits of vegetable structure, which I apprehend are fragments of tea leaves, and some other bodies which I cannot recognize, but which I believe to be altered blood corpuscles. It is obvious that these latter specimens, however interesting they may be from the stand-point of microscopy, throw very little light on the pathology of cholera. Examined with a high power (about one thousand diameters), I could discover no special or peculiar structure which could be called a specific cholera germ, in any of the specimens of intestinal discharges, but myriads of granules, far more minute than those already alluded to were brought into view, and I have no doubt that a yet higher power would have revealed other granules smaller still.

Having now completed the examination and description of the specimens furnished me, I propose in conclusion, to offer a few suggestions on the subject of contagion, since the resolution of this Society, under which I am acting, called for "special reference" to this matter. The patients from whom my specimens were obtained, both came from infected districts lying

south of us, just prior to being attacked themselves. In what form did they obtain the poison and how did they transport it hither? I think the microscopic revelations of the last few years, especially since the introduction of very high powers by Beale and others, are sufficient to warrant us in believing that all developmental or reproductive power resides in that portion of the cell which, following Brown, *we* call the "nucleus," but which Beale has very aptly named the "germinal matter," because it *is* the *germinal* matter; that this germinal matter multiplies with wonderful rapidity, and, in the majority of instances, by the process of "budding" or "gemmation;" that in its living state, germinal matter is not inclosed in a cell wall or closed sac, but is merely a little mass of soft gelatinous matter, wholly unconfined by any membranous envelope, and that it frequently exists in particles quite too minute to be seen by the highest magnifying powers at our command. But this is not all. The lowest forms of living matter are known to multiply with far greater rapidity, and to retain life with far greater tenacity than the higher forms; numerous examples illustrating these statements could be adduced did time permit. The experiments of Professor Tyndall and others, seem to indicate clearly enough that the lowest and most minute germs may be completely dessicated and blown about by currents of air, and yet retain their power of growth and multiplication; in other words, retain the principle of life. With these facts before us, it is easy enough to *reason* with some degree of intelligence and probability, not upon the *nature* of the cholera contagium, but as to the manner of its preservation and transportation. In all probability the blood is the primary seat of attack in every case of genuine cholera; at all events is very soon and very profoundly affected. Next in order, we have the choleraic discharges, and whether these discharges be "eliminative" or not, they take place with frightful rapidity, and they must be derived mainly from the blood by violent exosmotic action. In the next place, thoughtless and frightened attendants are *almost* certain to throw the dejections into defective drains, or into exposed cess-pools, or upon the ground in some secluded spot, where they are least likely to attract attention and most likely to do subsequent harm. But, with the greatest and most intelligent care, it is impossible to avoid soiling the floor or carpet or bedclothes, or all three, and, with the most assiduous use of disinfectants, it is equally impossible to secure *absolute* protection from the harmfulness of the discharges, if they possess the power to harm. As a plain matter of fact, we all know from practical experience that generally, hands, wearing apparel, bedclothes, carpets, furniture, each and all are more or less stained and soiled by the discharges, in the hurry and fright and excitement of administering to the many and urgent wants of a cholera patient; and precisely the same insane fright causes attendants to be neglectful of the proper use of disinfectants. Referring once more to the microscopy of the discharges, it will be remembered that numerous exceedingly minute granules were found to be present. Now these same granules, which our highest powers reveal, together with a presumably larger number which our highest powers do *not* reveal, are constantly escaping from the bowels; are constantly being ex-

posed to the sun's rays, to the air of heated rooms, and to moving currents of air, which dessicate them, and then waft them in all directions ; are constantly entering the mouths, noses, and lungs of those who are compelled to breathe the infected air, and also constantly falling upon our food, and into our drinks, and being carried thence to our stomachs. From a mucous surface, the way into the blood is direct and easy, and, once in the blood, these minute germs find an abundance of their most appropriate pabulum, and are therefore under the best possible conditions for rapid multiplication. But it is not necessary that the contagium particles themselves should enter the blood ; it is not even necessary that they should *all* be living ; indeed, it seems to me more than probable that the great majority of those that enter the stomach must undergo solution before entering the blood. But, granting that they are liquefied and then absorbed, it does not follow that the poisonous principle is annihilated or rendered harmless. This view of the mode of propagation and transportation of the cholera poison is strengthened by analogy. According to Beale, the cattle-plague, or "Rinderpest," which ravaged the cattle-herds of England a few years ago, and which was investigated by a board of commissioners, was propagated by exceedingly minute living germs, which were conveyed from herd to herd by some one of the modes of transit above mentioned. The fluid of the vaccine vesicle is now known to contain very minute granules, upon which the specific properties depend ; and our own Bartlett has lately shown us how paludal fevers may be propagated by minute spores. Finally, professional opinion everywhere is gravitating toward the "germ theory," because that theory, better than any other, explains the frequently rapid spread of the so-called zymotic diseases, as well as the peculiarities which we sometimes meet with in their manner of travelling from place to place.

CHOLERA IN WHEELING, WEST VA., IN 1873.

By S. L. JEPSON, M. D.,

Health Officer of Wheeling.

In the hope of contributing in some slight measure to the study of cholera as it occurred in the south and west during the past summer, it is proposed to give here an account of the disease as it existed in Wheeling, West Va. In order to a more perfect understanding of the facts here given, it may be well to say a word touching the topography of the city.

Topography. — Wheeling is situated on the east bank of the Ohio River (except the Seventeenth Ward, which is on Wheeling Island, and may be omitted in the consideration of the subject, as no case of cholera occurred in it), on "an average elevation of six hundred and forty feet above the sea level," and the "river bottom" on which two thirds of the city is built is forty feet above low water mark in the Ohio. That part of the city under consideration is divided into seven wards, numbered from north to south 1st, 2d, 3d, 4th, 5th, 6th, and 8th, the 1st being the highest and the 8th the lowest ground. Wheeling Creek, a stream of considerable size, divides the city between the Fourth and Fifth wards. The Eighth Ward is separated from the remainder of the city by a wide common, through which a small stream flows. The common is laid out in streets, and contains a number of residences recently erected. The whole city is surrounded by high hills, which so closely overlook the river that the city is cramped for room, and so extends in width only from one to eight squares, the average not exceeding four. The length is about four miles, and it contains a population of 26,000.

In order that an approximate idea may be had of the location of the cholera cases (the number of each house being given in an accompanying table), I will state that our streets running north and south are named, from the river, back, Water, Main, Market, Chaplain, Eoff, Jacob, Wood, etc.; those running east and west, First, Second, Third, etc., and each square from north to south contains one hundred numbers.

Sanitary Condition. — As a result of the proximity of the hills, upon the sides of which houses are built, in many places it is impossible to dig privy vaults that will not rapidly fill with water. In some parts of the city, too, the same state of affairs exists by reason of former swamps and small water-courses having been filled up, previous to any attempt at drainage. This is true, particularly in the spring and in very wet weather, of portions of every ward in the city. As a consequence, the city contains an unusual number of offensive vaults, many requiring cleaning every year, and some rapidly filling up, even in dry weather, after being cleaned. The city is badly paved and poorly sewered. Many of the streets south of the creek, and almost all

the alleys, are entirely unpaved, while that portion of the city is also most deficient in sewerage. The waste water from hydrants, kitchens, and stables, therefore, finds its way into the alleys and street gutters, while the more solid offal is thrown out, in the confident expectation that it will be speedily removed by some of the innumerable hogs which roam through the city.

As soon as the city became "threatened with epidemic disease" — an emergency in the absence of which the health officer has not the power to employ a single assistant, — a Sanitary Inspector was appointed for each ward with full power to compel the abatement of all nuisances. Men under the control of the Street Commissioner were kept constantly at work in some part of the city, and lime was scattered at intervals in the gutters and alleys. So that Wheeling, while not in a condition to especially repel cholera, was neither in a condition to especially invite it.

We will now proceed to detail the first reported cases, and refer to such others as seem to be of sufficient interest to merit some attention.

Case No. 1. — The first case that presented symptoms of cholera did not come to my knowledge until the end of the month in which it occurred, when I saw the death certificate, written "Cholera Nostras." The date of the attack was June 9, the patient, a German woman, aged fifty years, residence 2,114 Main Street, Fifth Ward, wife of the proprietor of a lager-beer saloon, which was in the same house as that occupied by the family, who lived in the rooms back of the saloon. The second and third stories were occupied by two families, six individuals being on the second floor, and four on the third. A man and son on the third floor were newspaper carriers, and a man and son on the second floor were laborers, with no regular place of employment. A privy vault was in common use at this house, and was also used by visitors to the saloon. The rear wall of the cellar formed one wall of the privy vault, which was in very bad condition, the fluid contents of the vault leaking through into the cellar of the dwelling. On June 9, about 3 P. M., after her morning work, this woman was suddenly taken with diarrhœa, full cholera symptoms rapidly developed, and after about three hours of collapse she reacted, but died on the sixth day with "cholera typhoid." This patient was subject to attacks of what her physician calls "gastric and intestinal catarrh" every summer. She had not been absent from the city during the summer, nor had any of the inmates of the house. No stranger had been visiting them, and no direct means of introduction of the disease has been discovered.

Case No. 2. — Male, aged twenty-two years; residence 3,600 Chaplain Street, Eighth Ward. In good health, temperate, and worked at the La Belle Iron Mill. The house in which this case and the succeeding one occurred, is a large two-story brick tenement, occupied by five families, containing nineteen individuals, eleven up stairs and eight down. Those persons engaged away from the house were occupied as follows: The father of Case No. 2, with two other men, worked at Hobbs' Glass House, which employs nearly two hundred hands; three at La Belle Mill; one a laborer without steady employment. The premises were in bad condition. The cellar was very damp, and contained a small quantity of offensive water; an open board drain

intended to carry waste water from the hydrant was defective and filthy; at the foot of the yard was an unused privy vault almost full, and but imperfectly covered. This patient had for several days been suffering with a diarrhœa, and was hence unusually prudent in diet. On the day of his attack with cholera, he walked to his physician's office, a distance of two squares, and fainted twice on his way home, from exhaustion caused by previous copious discharges. On this day, June 20, vomiting, cramps, and rice-water purging set in, succeeded by collapse, from which the patient reacted, and recovered after six days.

Case No. 3. — The next case was the mother of the above, aged sixty-one years. In only tolerable health. Had nursed her son, and was thus constantly exposed to the disease germs. Was suddenly attacked on June 28, having had no premonitory diarrhœa. Collapse occurred, followed by reaction in a few hours, and recovery on the 30th, the case being milder than No. 2. In about a week after her recovery, the husband had an attack of cholera morbus, from which he recovered without serious illness. None of these patients, so far as can be learned, were in any way exposed to the disease previous to the occurrence of the first case in the house.

Case No. 4. — Male, aged thirty years; residence 3,631 Eoff Street. In previous good health, moderate drinker, worked at the La Belle Mill, at which Case No. 2 was employed. Residence one and a half squares from cases Nos. 2 and 3, but there was no acquaintance even between the families, and no intercourse. After nearly a week's diarrhœa, by which he was not kept from his regular employment, this man was stricken down with cholera on the night of July 3. Collapse set in, followed by reaction in a few hours, and recovery after four days. The patient in all probability used the vault at the mill during his premonitory diarrhœa, and may thus have been exposed to the poison of the disease deposited by Case No. 2.

Case No. 5. — Male, aged sixty-six years; residence 2,523 Chaplain Street. Healthy, temperate. Occupation, Justice of the Peace. Had diarrhœa for nearly a week, which was checked before July 4, on which day he attended a picnic in the country. He committed no imprudence in eating, but drank freely of lemonade made with limestone water, and to this attributes his relapse. At 1 o'clock A. M., July 5, he was seized with violent symptoms, the disease rapidly developed, collapse coming on in a short time. Reaction, however, was brought about in a few hours, and the patient recovered after seven days' sickness. There was a total suppression of urine for fifty-four hours. The residence of this patient was nearly a mile from that of any previous case, and no possible connection with any other case can be traced. The premises were in good sanitary condition, but an alley in the rear, and a gutter at the side of the house, were sometimes offensive, but these were never a cause of complaint.

It is not necessary to give at length the history of every case, all essential facts being given in the accompanying table. The cases related below, however, seem to have some special interest by reason of their connection with each other or with other cases, and are therefore given somewhat in detail.

Case No. 7. — Male, aged sixty-two years; residence 3,824 Eoff Street.

Healthy, temperate. Occupation, night-watchman at the Riverside Nail Mill, which is on Main Street, extending from Twenty-fourth to Twenty-fifth streets. Employed with him was another night-watchman, Mr. A., who tells me that previous to Mr. H.'s sickness (Case No. 7), he (Mr. A.) had a diarrhœa for three days; but kept at his post in the mill, using the privy vault on the premises. He described his diarrhœa as being painless, and so loose and watery as to necessitate great haste in reaching the vault. It was also so prostrating as to compel him to lie at home for a week after it was controlled, which was quickly done by early treatment. Mr. H. had diarrhœa at the same time, and not only remained in the mill with Mr. A., using the same vault, but visited him at his house after he was compelled to cease work. His diarrhœa ran on for nearly two weeks before he was attacked with choleraic symptoms. On the evening of July 9, vomiting and purging set in, followed by cramps of the extremities and speedy collapse. The dejecta were decidedly rice-water in character. Recovery ensued after seven days illness, during which time typhoid symptoms existed, as indeed was true of almost every case that recovered.

Cases 10 and 11, were a man and wife, aged respectively, seventy-three and seventy years, residence No. 30 Fifth Street, healthy, temperate, the husband a manufacturer. Local sanitary condition very good, being high and dry, and the premises in perfect condition. The husband, a man of uncommon vigor for his years, was attacked with diarrhœa on July 20. Received medical treatment on July 21, but the diarrhœa was not checked. On the evening of the 22d, the stools were decidedly rice-water in character. On the morning of the 23d collapse set in; some little reaction manifested, but death resulted on the 24th at three P. M. Neither cramps nor pain at any time.

The wife was a constant watcher at her husband's bedside, and although in excellent health previously, was worn out with anxiety and nursing. She was attacked suddenly with violent symptoms at five A. M. of the 25th, and died in collapse at nine P. M. of same day. In this case vomiting, purging, cramps, and rice-water dejecta were all present. The only possible connection traced between these and other cases, is in the fact that Case 10 was in the habit of frequently visiting the mills in his business capacity, and several cases had occurred among the mill hands. The location of the cases was nearly two miles from any previous case.

Case 12. — Female aged fifty-two, residence 1,102 Chaplain Street, where she kept a boarding-house; was somewhat worn down by hard work and the cares of her occupation, otherwise healthy. Sanitary condition of the premises bad. In the yard but ten or twelve feet from the kitchen, and on higher ground, was a large privy vault which had been cleaned out in May by my order, but which had again rapidly filled up, owing to the nature of the ground, and was again exceedingly offensive, the contents of the vault escaping at one point on the side next to the house. One of these rooms was occupied by the patient as a sleeping apartment. This lady was in her usual health until the morning of her fatal sickness. The evening previous she had eaten a dish of ice-cream. On the morning of July 25, she went as

usual to the butcher shop one square distant, and on her return proceeded to prepare for the breakfast. She soon complained of not feeling very well, and about seven o'clock an exhausting diarrhœa set in. Two hours later violent cholera symptoms commenced, and the case resulted fatally at nine P. M.

Case 13. Male, aged forty-seven, temperate, healthy, an artist, two weeks from Philadelphia on a visit to a brother at No. 59 Twenty-sixth Street. Was attacked suddenly with great violence at eight P. M. on July 29, two hours after having eaten his supper. Was in a collapse when a physician reached him at ten o'clock. Recovered in a week. The brother had a similar, though less severe attack three days before. The case was not reported, being called cholera morbus.

Cases 14, 19, 32, 33, 34, and 35, constitute a group of considerable interest, and I shall speak of them together. They all occurred in a small frame house of two rooms on one floor, located in the Fifth Ward, on a high point overlooking Wheeling Creek, and nearly a half mile distant from any other dwelling on the same side of the creek. The house was occupied by two families, about ten individuals, nearly all unclean in their habits, and inebriates.

Case 14. Male, aged fifty-eight, occurred on August 29, was comparatively mild, and was not reported as cholera. The patient recovered on September 10.

Case 19. Female, aged twenty-eight, intemperate; occurred on September 2, was also mild, recovering on September 6, and was not reported.

The other cases occurred respectively on September 14, 19, 24, and 25, and were all fatal. It was not until the 25th that any case was reported to me. I immediately visited the house, where I found one person dead, one dying, and the third in a semi-collapse. A somewhat intelligent woman, who had been nursing these patients, gave me a full account of all the cases that had occurred, as did also the two patients who recovered, and I cannot doubt but that they were all the victims of the same disease. I found that there were no privy accommodations whatever on the premises, and the cholera dejecta had been thrown out on the ground in the neighborhood of the house. The floor of the dwelling was also in a horribly filthy condition. No attempt whatever had been made at either cleanliness or disinfection. Several of the inmates were in a besotted condition at the time of my visit. All was done that was necessary to put the premises in good condition, disinfectants having been freely used. Cholera had disappeared from the city proper on September 7. In this isolated position it lingered until these measures were enforced, after which no other case occurred.

Case 24. Male, colored, aged sixty-seven, residence in private alley near Tenth and Market streets, laborer, very intemperate, sanitary surroundings bad; house low, dark, and poorly lighted and ventilated. This man had been suffering with a diarrhœa for some days, and was much prostrated thereby, no medical treatment having been received. On September 3, at ten A. M., he was attacked with cholera, and died at twelve P. M. on the 4th.

Case 31. A daughter of the above, age twenty-six, prostitute, was attacked with diarrhœa on the 5th, but like her father, neglected it, and on September

7, at eight P. M., violent cholera symptoms set in, which terminated her life in six hours.

Case 27. Female, aged fifty-two, intemperate; had been in the city about a month, selling pictures from house to house. She was boarding at No. 1,214 Water Street, a German hotel. Had diarrhœa for some days. On September 5, at six A. M., was seen by the proprietor vomiting in the yard; ate no breakfast. Cholera in its usual form soon after developed; the patient was removed to the hospital, and died there at nine P. M. In the room with this woman was her husband, who, though making no complaint, had also diarrhœa, and when seen at nine A. M. had a cold, shriveled surface, feeble pulse, and slight cramps in the legs. He also was sent to the hospital, confined to bed, put under treatment, and in a few days recovered.

Before making any comments on the facts here given, we desire to refer to a most interesting group of cases that occurred in the country four miles away, and which are not connected with the epidemic in the city.

Mr. J. T. C., a medical student, for some months resident in the Good Samaritan Hospital of Cincinnati, Ohio, took passage for this city on the steamer *Andes* on June 13. On June 15, he was attacked with a painless, liquid diarrhœa, which continued without treatment until he reached home. The *Andes* landed at Wheeling on the morning of the 17th, and Mr. C. started immediately for his home, walking one and a half miles and riding in a wagon the remainder of the distance. The diarrhœa continued, and vomiting set in the next day. Mr. C. described the dejecta to us as "resembling water into which a small quantity of milk has been poured." Medical treatment, with perfect rest, wrought a cure. On June 21, four days after Mr. C.'s arrival at home, his mother, aged fifty-two, in previous good health, was attacked with choleraic symptoms, and after being sick a week, recovered. On June 25, Mr. C.'s grandmother, aged seventy-three, was similarly attacked, and died in twelve hours. On June 30, Miss C., aged nine years, was similarly prostrated, but recovered in about a week. Cramps accompanied all these cases except Mr. C.'s. Treatment was promptly administered by Mr. C., a very intelligent student, else the deaths might have been more numerous. The house in which these cases occurred is situated on a high point in the country, the family is possessed of ample means, and no sanitary defect existed. The cases could not be traced to any error in diet. It is worthy of remark that the first death from cholera in Cincinnati was not publicly reported until June 14, one day after this gentleman had left the city. Nothing resembling cholera had occurred in the Samaritan Hospital previous to his departure. That the cases were cholera, however, and that Mr. C. was the carrier thereof to his home, we cannot doubt.

Having now completed our account of the cases occurring in Wheeling and vicinity, we may state that the facts here given were received in no instance at second-hand, but directly from either the attending physician, or the patient and present friends, or in most instances from both. We have visited every house — with a single exception — in which any case occurred, and our aim has been to give facts exactly as they existed.

Mortality. — By a reference to the table, it will be seen that we had two

Cholera Cases occurring in Wheeling, West Va., in the Epidemic of 1873.

No.	Ward.	Residence.	Sex.	Color.	Age.	Married or Single.	Occupation.	Date of Attack.	Date of Recovery.	Date of Death.	Duration of Fatal Cases.	Local Sanitary Condition.	Habits and Physical Condition of Patient.	Remarks.
1	5	2114 Main St.	F.	W.	50	M.	Housekeeper.	June 9	–	June 15	6 days.	Bad.	Delicate health.	Premon. diarrhœa.
2	8	3600 Chaplain St.	M.	W.	22	S.	In Iron Mill.	20	June 26	– –	–	Bad.	Temperate — healthy.	Premon. diarrhœa.
3	8	3600 Chaplain St.	F.	W.	60	M.	Housekeeper.	28	July 1	– –	–	Bad.	Not very strong.	Sudden invasion.
4	8	3631 Eoff St.	M.	W.	30	M.	In Iron Mill.	July 3	6	– –	–	Good.	Healthy — Mod. drinker.	Premon. diarrhœa.
5	6	2523 Chaplain St.	M.	W.	66	M.	Justice of the Peace.	5	12	– –	–	Medium.	Healthy — temperate.	Premon. diarrhœa.
6	6	2629 Chaplain St.	M.	W.	60	M.	In B. & O. R. R. Shop.	6	10	– –	–	Good.	Healthy — temperate.	Half day's diarrhœa.
7	8	3824 Eoff St.	M.	W.	60	M.	In Iron Mill.	9	17	– –	–	Good.	Healthy — temperate.	Premon. diarrhœa.
8	4	1714 Eoff St.	M.	W.	48	M.	Street Paver.	16, 4 p. m.	–	July 17, 5 a. m.	13 hours	Bad.	Intemperate.	Premon. diarrhœa.
9	8	3426 Market St.	M.	W.	48	M.	Laborer.	21, 9 p. m.	–	23, 6 p. m.	45 hours	Good.	Good health.	Premon. diarrhœa.
10	1	30— 5th St.	M.	W.	73	M.	Manufacturer.	22, 8 p. m.	–	24, 3 p. m.	43 hours	Good.	Healthy — temperate.	Premon. diarrhœa.
11	1	30— 5th St.	F.	W.	70	M.	Housekeeper.	25, 5 a. m.	–	25, 9 p. m.	16 hours	Good.	Healthy — temperate.	Sudden invasion.
12	2	1102 Chaplain St.	F.	W.	48	M.	Housekeeper.	25, 9 a. m.	–	25, 9 p. m.	12 hours	Bad.	Worn down by care.	Sudden invasion.
13	6	59— 26th St.	M.	W.	49	S.	Artist.	29	Aug. 5	– –	–	Good.	Healthy — temperate.	Sudden invasion.
14	5	Poverty Point.	M.	W.	58	M.	Laborer.	Aug. 29	Sept. 10	– –	–	Bad.	Healthy.	Premon. diarrhœa.
15	2	1057 Morrow St.	M.	W.	59	M.	Cigar Maker.	30, 3 p. m.	–	Aug. 31, 11 a. m	20 hours	Good.	Very intemperate.	Premon. diarrhœa.
16	5	2219 Eoff St.	M.	W.	30	S.	In Iron Mill.	30, 4 p. m.	–	30, 11½ p. m.	7½ hours	Medium.	Intemperate.	Premon. diarrhœa.
17	8	3722 Eoff St.	M.	W.	35	M.	Teamster.	31, 3 a. m.	–	31, 11 a. m.	8 hours	Good.	Intemperate.	Premon. diarrhœa.
18	5	2224 Main St.	M.	W	28	S.	In Iron Mill.	31, 6 p. m.	–	31, 12 p. m.	6 hours	Good.	Intemperate.	Unknown.
19	5	Poverty Point.	F.	W.	28	M.	Housekeeper.	Sept. 2	Sept. 6	– –	–	Bad.	Intemperate.	Premon. diarrhœa.
20	6	2408 Short St.	F.	W.	38	M.	Housekeeper.	2, 8 a. m.	–	Sept. 2, 12 p. m.	16 hours	Medium.	An invalid.	Premon. diarrhœa.
21	8	Country Road.	M.	W.	32	M.	In Iron Mill.	2	Sept. 14	– –	–	Bad.	Intemperate.	Premon. diarrhœa.
22	6	3013 Market St.	F.	W.	48	M.	Housekeeper.	2, 12 p. m.	–	Sept. 9, 10 a. m.	6½ days	Good.	Healthy — temperate.	Sudden invasion.
23	1	North of 1st, on Main St.	M.	W.	40	M.	In Iron Mill.	3, 10 a. m.	–	4, 7 a. m.	21 hours	Medium.	Healthy — temperate.	Premon. diarrhœa.
24	2	Near 10th & Market Sts.	M.	Col.	67	M.	Laborer.	3, 10 a. m.	–	4, 12 p. m.	38 hours	Bad.	Very intemperate.	Premon. diarrhœa.
25	6	2407 Alley Court.	M.	W.	37	M.	In Iron Mill.	3, 9 p. m.	–	4, 12 p. m.	27 hours	Good.	Very intemperate.	Premon. diarrhœa.
26	8	3725 Jacob St.	M.	W.	48	M.	Shoemaker.	3, 12 p. m.	–	5, 6 a. m.	30 hours	Good.	Very intemperate.	Premon. diarrhœa.
27	3	1214 Water St.	F.	W.	52	M.	Peddler.	5, 7 a. m.	–	5, 9 p. m.	14 hours	Good.	Intemperate.	Premon. diarrhœa.
28	6	2318 Woods St.	M.	W.	44	M.	In Iron Mill.	5	Sept. 10	– –	–	Good.	Healthy.	Premon. diarrhœa.
29	8	3638 Eoff St.	M.	W.	57	M.	In Glass Works.	6	14	– –	–	Good.	Not robust—Mod. drink'r	Premon. diarrhœa.
30	6	2623 Jacob St.	M.	W.	23	M.	In Iron Mill.	6	11	– –	–	Good.	Healthy — Mod. drinker.	Premon. diarrhœa.
31	2	Near 10th & Market Sts.	F.	Col.	26	S.	Washerwoman.	7, 8 p. m.	–	Sept. 8, 2 a. m.	6 hours	Bad.	Healthy — Prostitute.	Premon. diarrhœa.
32	5	Poverty Point.	F.	W.	11	S.	Child.	14, 8 a. m.	–	14, 8 p. m.	12 hours	Bad.	Healthy.	Premon. diarrhœa.
33	5	Poverty Point.	F.	W.	55	Wid	Housekeeper.	19	–	30	11 days	Bad.	Unknown — intemperate.	Premon. diarrhœa.
34	5	Poverty Point.	F.	W.	41	M.	Housekeeper.	24, 10 a. m.	–	25, 5 p. m.	31 hours	Bad.	Unknown.	Unknown.
35	5	Poverty Point.	M.	W.	10	S.	Child.	25, 9 a. m.	–	26, 4 a. m.	31 hours	Bad.	Healthy.	Unknown.

distinct visitations of cholera. One commenced on June 9, or, if we throw out Case 1, on June 20, and ended on July 29, during which time only thirteen cases occurred, with six deaths, a mortality of forty-six per cent. The disease then suddenly disappeared, not a single case occurring until exactly a month later, August 29, from which time until September 7 no less than eighteen cases occurred, when it again departed from the city proper; four additional cases occurring, however, between September 14 and September 25, in an isolated dwelling, making in the second epidemic a total of twenty-two cases, with sixteen deaths, a mortality of seventy-three per cent. During the summer, then, there occurred thirty-five cases and twenty-two deaths, giving a mortality of sixty-three per cent. which certainly entitles the disease to be called *malignant*, whether it be of *Asiatic* or *American* origin.

Distribution of the Disease. — By a reference to the table it will be seen that, the cases were located by wards as follows: First, three; Second, four; Third, one; Fourth, one; Fifth, nine; Sixth, eight; Eighth, nine; thus the three last named wards, which are south of the creek and joining one another, contained twenty-six out of the thirty-five cases. The case in the Third Ward was not a resident of it, but a peddler temporarily stopping there, and who may have been exposed to the germs of the disease in some of the houses visited by her daily. She was a German, able to speak little if any English; the wards south of the creek contain the greatest proportion of our German population, facts which render it probable that she plied her vocation principally in that part of the city. The case occurring in the Fourth Ward was a street paver, and on the day of his attack and previously, was at work in the Fifth Ward. One of the three in the First Ward — the patient whose wife also died — was in the almost daily habit, in conducting his business, of visiting the nail mills in the Sixth Ward. It is evident that the disease was in a great degree localized in the three lower wards.

Local Sanitary Condition, Effects of. — After a careful study of these cases, we are not convinced that the comparative uncleanliness of different parts of the city affected the location of the cases, since there is no great difference in this respect between the different wards. The Third and Seventh are always the cleanest, and contained but one case, but the Second, which contained four cases, and the Fourth, which contained but one, are both less cleanly than the Eighth, which contained nine cases. The latter, however, as already stated, is the lowest, and next to it the Sixth and Fifth, which likewise are perhaps generally in the poorest sanitary condition, being to a very great extent unpaved and unsewered. Thus elevation, rather than cleanliness, seemed to exert a protecting influence, if indeed we are justified in drawing any conclusion where so few cases occurred.

The sanitary surroundings of the houses in which cases occurred, certainly did not in many instances exert any great influence. We have endeavored in the table to give some idea of the condition of each house visited, and its surroundings. Of course this can be but imperfectly done without a full description of the premises. The local sanitary condition

is regarded as having been *bad* in four cases, *medium* in fourteen, and *good* in seventeen. In but four or five instances were the sanitary defects so bad as in our opinion to serve in any great measure as the predisposing cause of cholera. Certain it is that, with these few exceptions, many much worse places entirely escaped; while a number of the houses visited were very favorably located, and in excellent condition.

Habits, etc., of Persons attacked. — We are convinced that in this, as in other epidemics of cholera, the personal habits and mode of life, together with the previous state of health of those attacked with the disease, had much influence not only in inducing the attack, but also in bringing about a fatal termination. It will be seen that thirteen of the patients had been intemperate, three of them moderate drinkers, four in impaired health, and fifteen in good health, of which last number, three were over sixty-five years of age. Others might possibly be added to one or other of the unfavorable classes here named, were full data at hand. But even with these partial positively ascertained facts, we have a total of twenty-three persons who, by reason of either habits of drinking, previous ill health, or advanced years, were certainly not in a condition to resist this disease (I might also add to this list two fatal cases in children aged ten and eleven respectively). Of these, no less than sixteen died, a mortality of seventy per cent. Of the remaining twelve, previously temperate and healthy, six died, being fifty per cent., and two of these received no medical treatment, nor any proper care or nursing until *in extremis.*

It will be observed also, that ten out of the thirty-five persons attacked were employed in some of our iron mills. They are generally men of robust constitution, but careless concerning their health and habits of living. The business calls them to labor in an atmosphere whose temperature is excessively high; and very commonly after finishing a short piece of work, they step to the coolest place they can find, and sit down until their services are again required, often also drinking freely of ice water, and sometimes having cold water by the bucketful poured over their naked backs, from which the perspiration is streaming. To this we find a number of these men attribute their sickness; and that it had an influence as in some measure an exciting cause we are inclined to believe.

Premonitory Diarrhœa. — It is worth while to note the large number of cases in which premonitory diarrhœa occurred, viz., twenty-seven. The duration of this diarrhœa varied from half a day to over a week. We had during the epidemic an unusual number of cases of diarrhœa in the city, in which the stools were very liquid, and often of a light color, being generally described as "milky." Judging from the readiness with which these yielded to treatment — though a few of them were quite rebellious, — we cannot doubt but that a number of deaths could have been prevented, had the patients given early warning of the existence of a diarrhœa, and at once placed themselves under intelligent medical treatment. This is a point already well established by past experience, and it should be impressed upon the public on all proper occasions.

Sanitary Treatment. — The Health Officer is the sole health authority in

Wheeling, save a "Committee on Health" of the City Council, to whom the Health Officer is responsible. The statutes require physicians to report all cases of "Asiatic Cholera" to the Health Officers immediately on their recognition. Great doubt, however, existed in the minds of physicians here as elsewhere, as to the exact nature of the disease when it first appeared. Hence there was a hesitancy in announcing a case to be cholera, and hence delay, and often entire failure, to report the cases. Again, the law, having no penalty attached, was disregarded without even this excuse. Even late in the epidemic, in some instances the first intimation the Health Officer received of the existence of a new case was from the local columns of the morning papers, or from rumors heard on the streets. As soon as discovered, however — which was sometimes done by tracing these street rumors — in all cases measures for thorough cleansing and disinfection were instituted. Whether any positive good was accomplished by the use of disinfectants, is a problem we are unable to solve. All the facts to be derived from our observations on this subject, may perhaps be best briefly expressed as follows: —

Case 1 disinfected, promptly. No second case.

Case 2 not disinfected. A second case (No. 3), after which disinfection. A case called cholera morbus occurred after this.

Case 4 probably not disinfected. No second case.

Cases 5, 6, 7, 8, and 9, disinfected. No second case.

Case 10 disinfected. A second case (No. 11), the wife, who died the next day.

Case 12 disinfected. No second cholera case. Two cases of diarrhœa, neither severe, and a case of cholera morbus, after disinfection.

Case 13 disinfected. No second case. This case followed three days after a case of what was called cholera morbus, which was not disinfected.

Case 14 not disinfected. Five additional cases (19, 32, 33, 34, and 35) followed before disinfection, after which there occurred no other case.

Cases 15, 16, 17, 18, 20, 21, and 22, disinfected. No second case.

Case 23 disinfected. Two children of this patient attacked with diarrhœa and vomiting the next day, which in both cases were easily controlled by immediate medical treatment.

Case 24 disinfected. A second case, a daughter (No. 31).

Cases 25 and 26 disinfected. No second case.

Case 27 disinfected. No second case. The husband of this patient had mild cholera symptoms at the same time, and probably contracted the disease in the same way.

Cases 28 and 29 disinfected. No second case.

Case 30 not disinfected at all. A young child died with cholera infantum ten days after this case occurred.

In none of the cases was disinfection resorted to until active cholera symptoms set in. It may hence be argued that in the instances in which more than one case occurred, the later cases were caused by the poison of the premonitory diarrhœa. On the other hand, it may be pertinently in-

quired, why did not multiple cases more frequently occur, since premonitory diarrhœa existed in three fourths of the cases? Accepting the doctrine that the dejecta are the principal source of infection, the following facts lead one to conclude that the excreta of the premonitory diarrhœa are devoid of cholera germs, or at least that these germs are possessed of very feeble reproductive powers. As noted in the table, ten of the subjects of cholera were iron mill hands, employed in four different mills, in which not less than seven hundred men are employed. About all these cases suffered from premonitory diarrhœa, and before giving up work used the privy vaults frequented in common by all the men working in the mills. In no case was disinfection used in any of these vaults.

Is it possible that cholera germs could have been destroyed by the disinfectants always present in the atmosphere of iron mills.

Mode of Introduction to the City.—This point we have purposely postponed discussing until now, in the hope of gaining some accurate information on the subject. It has already been seen, from the account of cases above detailed, that no history of direct importation has yet been traced in connection with any case. We are satisfied, however, after diligent investigation of the subject, that the disease was brought to this city by steamboat direct from Cincinnati. The cases occurring in the country we know positively to have been the result of importation. But Mr. C. did not stop in the city at all, merely passing through afoot to his home. Besides, our first case occurred eight days prior to his arrival. And if we exclude this as one of aggravated cholera morbus, the next, which occurred June 20, three days after Mr. C.'s arrival, was located about two miles from the steamboat landing. The same is true of the next five cases, while but one case occurred very near to the wharf.

All the facts we have been able thus far to gather, are briefly these: An officer of the *Andes*, a boat plying between Cincinnati and Wheeling weekly, informed us, that during June and July, they brought from the former city a large number of persons who suffered on the route with some form of diarrhœal disease. Some of these were simple diarrhœa, while others were attended with vomiting and severe pain. He kept several bottles of "cholera mixture" on board, and had frequent occasion to employ it. This officer gave us particulars of three cases that he remembered as being especially severe, but could not recall the names, and the boat being laid up at Cincinnati on account of low water at this time, he has not access to the books. Two of these sick persons were men, who disturbed the passengers by their loud cries of pain through the night. Another, was an old lady who, with her husband and daughter, took passage at Cincinnati. This was soon after cholera was reported in that city, and the officer thought that they were by its presence induced to leave the place. This lady took sick about Pomeroy, and was exceedingly nervous, and apparently alarmed. Some of the cholera mixture was administered, but she grew so much worse that at Parkersburg a physician was sent for. She improved before reaching Wheeling, but was so sick still as to require a carriage to convey her to her residence in this city. We hope yet to obtain the full facts concerning this case.

The porter on the *Hudson*, another weekly Cincinnati packet, informs us that the bar-keeper on that boat suffered a severe attack of what he called cholera, on his way up the river, and he also was compelled to secure a physician at Parkersburg. The porter described the excreta as being very white. This man is now in Cincinnati, and we have been unable to learn where he stopped in this city, where his clothing was washed, and other facts of interest connected with the case.

Although these facts prove nothing conclusively as to the importation of cholera into this city, yet they indicate a probable mode of introduction, and encourage further investigation in this direction.

Meteorological Observations. — Monthly Means.

1873.	Maximum Temperature.	Minimum Temperature.	Mean Temperature.	Rainfall in Inches.	Number of Rainy Days.	Number of Cloudy Days.	Number of Clear Days.	Prevailing Winds. Number of Days of Each. N.	S.	W.	N. W.	S. W.	S. E.
May	86°	44°	62.66°	5.95	10	2	19	5	3	–	7	14	2
June	92°	60°	75.33°	3.98	10	5	15	5	1	3	9	12	–
July	94°	56°	75.66°	8.72	16	2	13	5	–	1	5	18	–
August . . .	90°	60°	69.66°	8.55	11	6	14	13	4	–	2	9	1
September .	84°	50°	65.16°	3.08	8	6	16	13	5	–	3	9	–

Storms, with thunder and lightning, occurred on May 9, 20, 27; June 24, 27; July 4, 5, 14, 15, 18, 26, 29; August 25, 27, 28. Storm, with hail, on August 12. Frosts occurred on May 14, 15, 18, and September 15. Light snow on September 13.

NOTES. — First half of *June* very dry. Only 0.23 in rainfall in first twenty days. Balance of the month wet. First cholera case seen on the 27th. First half of *August* attended with bad cases of cholera infantum and cholera morbus. Typhoid fever and erysipelas the prevailing diseases. Typhoid fever became epidemic about the middle of *September*, and was generally of a mild type.

For the above meteorological observations we are indebted to Dr. E. A. Hildreth, of Wheeling.

REPORT UPON EPIDEMIC CHOLERA AS IT APPEARED AT JONESBOROUGH, TENN.

By W. R. SEVIER, M. D.,

Of Jonesborough.

The disease appeared in Greeneville, Tenn., a town situated on the line of the East Tennessee, Virginia, and Georgia Railroad, twenty-five miles west of Jonesborough, between the 18th and 20th June. Many cases were of a malignant character, the patients dying within a few hours after they were attacked.

Some four or five weeks elapsed from the time of its departure from Greeneville, before it assumed an epidemic form in Jonesborough. During this period quite a number of cases occurred in the intervening country, some of which were of a very malignant character. Two cases, both of which were refugees from Greeneville, occurred here some days prior to its actual development as an epidemic. One of these was of a violent type, the other was mild — both recovered. The first case among our resident population was the wife of a gentleman who had waited constantly at the bedside of the first mentioned case from Greeneville, in the capacity of nurse. The houses were a quarter of a mile apart. Those who believe the disease to be contagious impute the attack to the poison conveyed in the clothing of the husband. No other case occurred after that date (July 13), until the 24th of that month, when it, at once, assumed an epidemic form. The period marked by the greatest fatality was from 29th July to August 1, inclusive of both dates.

The disease almost uniformly was preceded by a painless diarrhœa,[1] passing rapidly into rice-water discharges, cramping of the voluntary muscles, coolness of breath with extreme coldness of tongue, capillary congestion of face, nose, ears, and extremities, with total suppression of the functions of liver and kidneys.

No regard seemed to be paid to locality or surroundings. Residences on elevated points and those in the valleys were, alike, subject to the visitations of this pestilence.

The same sort of disregard was manifested to localities, whether clean or filthy. The town was thoroughly policed a month or more beforehand. Every privy, public and private, was either thoroughly renovated or disinfected. Old pits were filled up with fresh earth, when practicable, and new ones dug. Lime, chloride of lime, sulphate of iron, carbolic acid, etc., were freely used. The disease, notwithstanding all this, was of an exceedingly

[1] An exception to this occurred in the person of a negro man belonging to the grave-digging force. Cramps preceded the diarrhœa, as reported to me by his associates. He died in about four hours after the attack.

malignant type; some of the patients who were of a naturally robust constitution died in from four to eight hours after the attack. It appeared alike indifferent to habits of personal cleanliness or filth. The discharges — ejections and dejections — of patients were always, at once, removed from the sick room and carefully covered with earth. Disinfectants also of almost every kind were diligently and liberally employed in the sick room and about the bed.

The major part of our population trusted to the "strength of their legs," and sought safety by flight. A few, but very few, were attacked in their places of retreat. After we had formed a theory more satisfactory to us at least than the opinions of authors, the remaining population was placed on muriated tincture of iron, — ten to twelve drops, morning, noon, and evening. It is not remembered that a single individual of those left behind who used this prescription was attacked; but returning refugees did not appear to enjoy a like immunity. Three individuals, all females, were attacked within a day or two after their return to town. They had, however, employed the preventive means rather carelessly and irregularly. Their cases yielded promptly to the remedy hereinafter mentioned.

Some four or five gravel train hands were attacked with the malignant form of the disease. Our hotels were closed. The inmates of our county jail were not attacked until some time after the first appearance of the disease among us. The jailer, who had labored under hemiplegia for perhaps twelve months, died. A colored female prisoner was subsequently attacked, but her case was of a rather mild type.

Observations and Results. — Diligent observation of the symptoms presented by a large number of well-developed cases of cholera, has fully satisfied me that the disease is *toxæmia*, or blood-poisoning. My reasons for this diagnosis are substantially as follows: The usual indications of the initial stage are diarrhœa and vomiting, the former rapidly assuming the character of rice-water discharges, composed, in a large measure, it is universally admitted, of a portion of the constituent elements of the blood.

The mental lethargy, physical prostration, depression of vital energies, and the suppressed functions of the liver and kidneys, are but the results of toxical influence acting primarily on the blood; and are such effects as might reasonably be apprehended from the introduction of a poison into the circulation. The symptoms characteristic of uræmia and pyemia are not, I conceive, more distinctly suggestive of blood-poisoning than are the general features of a well-developed case of cholera. Diarrhœa, although present in a large majority of cases, is not an essential feature of the disease. Many instances occur in which the prostration of the vital energies bears no sort of relation to the frequency or amount of such discharges.

Deaths have occurred ten or twelve hours after all discharges had ceased, notwithstanding every effort at stimulation and alimentation; the general symptoms meanwhile exhibiting, no less conspicuously, the depressing effects of a powerful poison.

The uniform effect of remedies of acknowledged depurative and disinfectant virtues has been, in nearly every instance, the relief of vital organs, and

the restoration of their functions. The litmus test applied to the ejections and dejections revealed the highly alkaline condition of both. These facts indicated not more distinctly the real character of this malady, so fearfully destructive of human life, than the agent which, in some one or more of its combinations, would prove the effective remedy, namely, *chlorine.*

The patient first selected, on whom to try the virtues of the remedy, was a "nymph du pave" who had been pulseless for several hours. Chlorate of potassa was employed hypodermically, and prescribed internally in doses of one and a half grains every hour. At the end of twenty-four hours she was still alive. She was next placed on muriated tincture of iron, in doses of ten drops every hour. She was found still living at the end of another twenty-four hours. We next employed solution perchloride ferri. No observable advantage was realized. She died in the evening of the third day, having been totally destitute of pulse for more than sixty hours.

Finally, the writer would briefly state his conclusions, as follows: —

(1.) The belief that cholera is of a special zymotic origin, as expressed in his report, is not entertained by him to the exclusion of the possibility that it also has atmospheric relations in its causation. In the latter case, however, the morbific agent seems to exist in the exhalations from the lungs, as well as those from the discharges from the stomach and bowels; and the medium through which it enters the circulation is, perhaps invariably, the lungs. The peculiar or specific poison is believed to belong to that class defined by Liebig as capable of *reproduction.*

(2.) The established power of chlorine as a disinfectant and the recognized virtues of its compounds, as hydrochloric acid, chloride of sodium, chlorate of potassa, muriated tincture of iron, bichloride of mercury, etc., appear to give additional strength to the theory.

The muriated tincture of iron was found to be in nearly every instance — perhaps all — where it was regularly employed, a thorough preventive. The presence of this, or of any other acid, in the discharges from the stomach and bowels was disproved by the litmus test.

(3.) *Hydrochloric acid is believed to be deficient in quality or altogether absent iu every case of cholera whether of atmospheric or of zymotic origin.* The preventive and curative virtues of its compounds furnish arguments *a priori* and *a posteriori,* which the writer commends to the consideration of the members of the Public Health Association as well as of the profession generally.

CHOLERA IN KNOXVILLE, TENN., AND VICINITY, IN 1873.

By F. K. BAILEY. M. D.,
Late Health Officer of Knoxville.

In commencing an account of cholera as it appeared in Knoxville and adjacent localities during the summer of 1873, it may not be superfluous to give some facts and dates commencing with the year, or earlier.

During the month of December, 1872, this region was visited with the epizoötic, which in a day prostrated every horse in the city and its environs. The disease had appeared in Virginia, Georgia, and other Gulf States, and even in Upper East Tennessee, before coming here. It continued about six weeks, and subsided nearly as suddenly as it appeared.[1] It was mild in type, and it is said no horse died during the time, except one or two which had pleuro-pneumonia. The owners of horses had taken wise precautionary measures in advance, and the stables were, without exception, in a good sanitary condition. Upon the very wake of that most wonderful disease which affected the equine race, a catarrhal fever began to affect the human species, and in some instances was very severe.

It commenced with the ordinary appearances observed in influenza, and continued unabated from seven to fourteen days. The spring season was about a month later than usual, and dampness with coolness conspired to render the whole community less able to recuperate after the varied ills of the preceding months.

During the latter part of May was noticed a tendency to looseness of the bowels, and cholera morbus. Vernal remittent was common, with an unusual tendency to assume an intermittent type. Early in June, diarrhœa was quite common among the children, and about the middle, became more like cholera infantum. About the 15th, cholera morbus became common among adults. Both white and black were attacked, but none died up to the 24th.

The death rate for May and June was less than in any corresponding season for some years. A few cases were attended with severe cramping, with other violent symptoms.

During the period embraced in the above account, no special sanitary measures had been adopted by the city authorities. As usual in every season, the carts were placed upon the streets every Saturday, to carry off the accumulations of the week. There being no sewerage system, all the water runs off in the street gutters, and the ground being universally undulating, the surface drainage is most excellent. While streets and alleys had been washed clean, hot weather in June found many backyards, cesspools,

[1] See Report of Dr. A. B. Judson upon this Epizoötic; *ante*, pages 188 to 209. — E. H.

and privy pits in a bad condition. Upon the appearance of choleraic disease in Nashville, a Board of Health was appointed by the Mayor, consisting of six medical men. All suggestions made by this board were authorized by the acts of the City Council. The market-house, a substantial brick structure, was thoroughly cleaned. The floor (of brick) was daily swept, and the qualities of vegetables, meat and fish, were made a matter of inspection every morning, by the Chairman of the Board of Health; besides each member was expected to give his personal attention to any or all conditions considered injurious to the public health. Unripe potatoes, cherries, and green apples, were not allowed to be offered for sale. All stale vegetables and unwholesome meat were thrown out; on the 21st, fish of all kinds were included in the list.

During the month of June, to the 24th, no death had occurred from bowel complaint.

The people, by circular, were advised to use dry earth and copperas water in their privies. The police were especially instructed to report nuisances at once.

June 23, I was called to see a woman sick with characteristics of cholera. Besides profuse vomiting and purging, there was cramping of the stomach and limbs, especially of the arms. She came from Georgia three weeks before, but had been free from disease, although poor and ill-fed. The general complexion of the case suggested cholera. She recovered in a few days, and soon left town.

On the 24th, a large man, weighing two hundred and twenty-five pounds, of robust physique, about forty years of age, but intemperate in his habits of eating and drinking, was taken sick at 5 P. M. He died at midnight, and his physicians state that his symptoms were decidedly choleraic. He had not been away from home, or in communication with any one from whom the disease could have been contracted. The facts showed that imprudence in diet was the exciting cause. No one was taken sick who attended him during his illness. The next case was that of a German, fifty years of age, who was driving a team drawing stone. He had not been away from home for a long time, and lived some distance from the case just related. Was wet on the day before his attack, and had not changed his clothing after his work was over. Taken next morning, July 1, with vomiting and purging, preceded by cramping, and died at night. Was intemperate and careless in all his habits.

The next case was that of a widow woman, about forty-five years of age, who died July 3. Had diarrhœa for three days, went into collapse, after which she lived but a few hours. She lived half a mile or more from either of the other cases, in an old section of the city, and in moderate circumstances. Upon the premises was found an old and neglected privy which might have been in use for thirty years. She had not been away from home at all. July 4, a man about sixty years of age, and drayman employed about town, died with choleraic appearances. His physician, a German, conversant with disease in this country and Europe, decidedly pronounced the case cholera. The man lived half a mile from the last case, and still farther removed from the others.

Up to the 12th there was increased tendency to choleraic disease. In Water Street on the 9th, I was called to see a colored girl, twenty-one years of age, laboring under the usual category of cholera symptoms, and within twenty-four hours two more cases occurred in the same house, but in different families. The girl recovered, but the others (colored man and wife, over fifty years of age) both died. The man had unquestionable cholera. The wife had indications of gastro-enteric inflammation from the first, but the dejections were rice water.

July 14, a man about forty years of age died in a house nearly opposite where the three cases just related occurred. His symptoms were most unequivocally choleraic, and his general appearance was suggestive of the cholera of 1854. His family had gone to the country, and for three weeks he had, with two other men, done their cooking, and lived on meat and vegetables which could be cooked with the least trouble. Green corn half cooked, was said to have been prominent as their diet. The principal attendant upon this man as nurse, was his father-in-law, Miller, who came to town from the country incidentally, and found his son-in-law sick. Miller, as soon as the corpse was buried, took the bedding upon which it laid into a wagon and rode upon it about twenty miles to his home. A few days after, Miller sickened and died. His physician and two daughters also were attacked and died within a few days.

July 9, I attended a mulatto girl, twenty-five years of age, who had collapse and barely escaped death. She lived on the same street (Water), but one block above. In the same family two other adult females had choleraic diarrhœa, but timely medication stopped it.

July 13, a French lady, in comfortable circumstances, and past middle age, living exactly opposite the house where the first cases occurred on Water Street, was taken and died soon after with decided cholera symptoms.

In this same locality, comprising a distance of five blocks, upon the same street, and near First Creek, there were perhaps as many more cases as I have enumerated, which occurred during July. Most, if not all, the families living on this street used water for drinking and cooking from a spring upon the bank of the creek and overflowed during every heavy shower.

After the 20th July, there was an abatement in the disease. I will state in this connection that about the 25th a lady died at Tate's Springs, ten miles from Morristown on the Virginia and Georgia Railroad. She was one of the proprietors of the property upon which the Springs are situated, and had not been away from home. Her case was pronounced by some as "Congestive Chill," but from subsequent information I have no doubt of its choleraic nature. The premises were in a wretched condition, no care having been exercised in disposing of garbage thrown out from the kitchen for a year or more. The privies used for a large company of boarders, were without pits, and it is said that the offal of beef cattle, which were slaughtered from time to time, had been thrown out upon the surface, and uncared for. No other cases occurred at this house.

July 30, a negro man of forty-five or fifty, was taken sick and died in a

few hours, of decidedly choleraic symptoms, intemperate and reckless in habit; lived across a bridge over First Creek, near the affected locality, and used water from the same spring alluded to. No case followed in his family.

Up to this date no case had occurred in the city, the subject of which had been away from home. About the 1st August, a railroad man employed on the trains running between Bristol and Chattanooga, was taken sick at a town about twenty miles below Knoxville, and stopped off here. He was taken to a boarding-house and medical aid called. His symptoms were most decidedly choleraic, having reached collapse. He recovered after a sickness of two or three weeks, but no one who attended him or visited him in his sickness contracted the disease.

July 26, a woman living in the city, received a dispatch from Jonesborough, one hundred miles northeast on the railroad, stating that her father, mother, and two sisters were sick with cholera at that place. She started at once, and arrived on the 27th. On the 29th she was taken sick with diarrhœa, and started immediately for home. Arrived here at noon on the 30th, but prostrated from vomiting and purging. She had slept but four nights out of five, and, while at Jonesborough her parents and two sisters died. This woman lingered some days and died. The dejections from the time of arrival home were dark brown and yellow, and she informed me they were of that appearance from the first.

No case occurred in the house where she died, but a younger sister who was with her more or less during her sickness, went to her home half a mile distant, and after a week or more sickened and died. Her case was pronounced cholera by her physician. Another sister still, died of reported cholera in about a month afterwards. Seven died from this one family, four in Jonesborough and three here.

I should have remarked that the railroad man passed through Greeneville and Jonesborough on his trains, and cholera was rife in both places.

August 15, a woman of fifty-five or more, was taken with cholera in another section of the city. The whole family had eaten watermelons quite freely, but otherwise there was no special cause to which the attack could be attributed so far as diet was concerned. On the same day a niece of this woman had diarrhœa, and some younger children in the same house were complaining, but nothing choleraic, except diarrhœa. About the same time, and within a week, there were some twelve or fifteen cases of the disease in various degrees of severity, within a distance of three blocks on this same street. Of the number two only proved fatal. One was a colored infant less than two years old, which died in a few hours, and had no treatment to avail anything. This case occurred upon the southern limit of the affected district, and the other, upon the northern limit, was a colored man who worked in a rolling mill, but had neglected a diarrhœa for two days. Along the banks of this creek, there are two springs from which the people obtained drinking-water. One of these springs is subject to overflow in high water, besides being so situated that surface water from the adjacent higher ground readily washes into it during a heavy shower. The people

were advised to use cistern water until the springs could be examined and cleaned, and no more cases occurred.

So far as I know, none of the persons affected in this district had been out of town, or in communication with other cholera cases.

During the latter days of August and the first ten of September, there occurred some fifteen cases of disease more or less choleraic, in a section upon First Creek and the vicinity, but farther up than the locality above mentioned on Water Street. Of this number about half proved fatal. Some were dysenteric, but equally severe. Some of the families in this district used water from springs which were subject to overflow from surface water, besides receiving the wash from a couple of slaughter-houses situated above. It may be remarked in this connection that along both banks of each creek running through our city, there were last spring great numbers of privies, the contents of which more or less were washed into the streams. This filth finds its way into the springs, and contaminates the water.

As the city extends along the creeks, for quite a distance, it will be seen that this is an important fact to be considered among the exciting causes of cholera, as well as other diseases.

In August there were six fatal cases of choleraic disease, at a place called Wallace's Cross Roads, twenty-five miles or more northeast from Knoxville. Colonel William Wallace, a prominent business man, and of good temperate habits, was taken with diarrhœa which was not noticed as worthy of attention for two days. At length cramping and collapse set in, and death rapidly ensued. A man in the employ of Colonel Wallace, who boarded in the family, attended him in his sickness, and assisted at the burial, soon sickened and died. Four other fatal cases occurred in the vicinity, and one man recovered, who was attacked. This locality is nearly two miles from the Knoxville and Ohio Railroad, which only runs within twenty miles from the Kentucky line.

I learned that the spring on Colonel Wallace's farm is lower than the house and outbuildings, and that surface water could run thence into the spring, from which drinking-water is obtained.

None of these persons had been in communication with other places so as to contract disease. Their diet had not varied from the usual fare among farmers.

While cholera was prevailing in Chattanooga, and during the first half of July, a family came from that place to Knoxville on the railroad. On their arrival, one of the children, a boy of eight or nine, was sick with diarrhœa. His mother took him to Dr. J. M. Boyd's office, where some opiate mixture was prescribed. The family went immediately into the country five miles. Being very poor, the whole number were destitute of food, and consequently much exhausted on arriving at their place of destination. They ate green vegetables on their way, and especially of cucumbers. Six deaths occurred within a few days in this family and others with whom they communicated, and the disease was pronounced cholera by the physicians

who attended them. The place is known as Fountain Head, and the point where First Creek has its origin.[1]

TOPOGRAPHY.

Knoxville is built upon the north bank of the Tennessee River. The ground rises from the river about one hundred feet in the distance of six hundred. The soil is a heavy clay mixed with chert rock, which is so broken up as to leave cavernous openings at different places serving as drains for water. Emptying into the river are First and Second Creeks, the distance between their mouths being about three thousand feet. The ground rises from the west bank of First Creek to a level with the elevation from the river, and then descends to the east bank of Second Creek. This high ground terminates abruptly, about half a mile from the river, at a point where the surface was originally low and marshy. Along this low space, the tracks of the several railroads are laid. Beyond the railroad, commences a gently undulating section upon which the newer part of the city is built. East of First Creek, and west of Second Creek, the ground rises rather boldly, and, it will be seen, the whole area is susceptible of excellent surface drainage, except in the vicinity of the railroad.

The original town was first laid out about the year 1792, along the river bank, and on both sides of First Creek. The subsequent extension for forty years, was towards Second Creek, with but little improvement to the north. The creeks being rapid streams, mill-dams were thrown across at intervals, which caused more or less ponds of stagnant water, and in 1838, there was an endemic fever prevalent, which, in severity and fatality, was almost equal to the scourge now visiting our sister city, Memphis. Some of those dams still remain, and it will be remembered, a greater portion of the cholera cases described above occurred along the creeks. The beds of these streams are solid rock, the outcropping of the formation which underlies the whole region. In the inequalities and interstices of the creek beds is afforded a lodgment for filth of every description, which is exposed to the sun in summer.

On First Creek, in less than half a mile, are four mill-dams, and the water is carried from the ponds thus produced, in canals to the several mills. It will be seen then, that the beds of the streams in dry weather will be entirely bare, and the water in the canals or "races," more or less stagnant.

These creeks are becoming mere open sewers, and receive the drainage of all the streets which run at right angles with them in the old town, most of that which accumulates on the railroad grounds, and all, from the territory still further north.

[1] Since the foregoing was written, I was told that a woman (white) died on the border of First Creek near its mouth, about the middle of October. The morbid appearances are said to have been decidedly choleraic. Spring-water was used, as no other is to be had in the vicinity.

November 3, a boy of eight (Irish), whose parents live near the same creek, but just across the bridge from where so many died in July. Dr. Boynton, the attendant, informs me that the boy was in collapse when he was called, which was but a few hours after the attack.

PROPHYLACTICS.

A few words upon the measures employed to prevent the spread of disease.

The Health Officer and Sanitary Police were notified of every case as soon as possible, and a visit was made to the premises. The attendants were directed to put a solution of carbolic acid in every receptacle of the dejections, and to cause the whole to be buried in the earth instead of being thrown into the privy vault. Should the sick have been to the water-closet before taking to the bed, copperas water was to be poured in freely, and in most instances lime was thrown in. In case of death, the bed and bedding were generally put into boiling water, to which a solution of carbolic acid was added. In some cases the beds or mattresses were burned. In no instance did any one contract the disease from washing clothing, so far as reported. The people were advised to use copperas once a week in their vaults, and it was very generally attended to. The streets and alleys were kept free from filth, and all dead animals buried immediately. The Sanitary Police made frequent visits to every lot, and especial care was taken to respond to any report of nuisances existing.

There was difficulty in regard to deodorizing privy vaults which were even well constructed, by reason of neglect on the part of owners and occupants of premises. Especially was there embarrassment, when no good privy existed, or it was built upon the edge of a creek or ravine. Neglect of such places is apparent everywhere, and people are too indifferent in regard to what is encountered by their olfactories.

PREVAILING WINDS.

Much has been written upon the question whether the direction from which the winds blow, influence cholera visitations. Below are given statements in regard to weather, during June, July, August, and September last.

The monthly mean of the barometer in June was 29.993 ; mean of the thermometer, 74.3. Highest at which the mercury stood was 91 ; lowest, 61. Rain-fall, 5.94. Prevailing wind, S.S.W. Number of miles travelled, 4,010. Highest barometer, 30.31 ; lowest, 29.07.

July : Mean monthly barometer, 30.061 ; highest, 30.31 ; lowest, 29.88. Mean monthly thermometer, 76.2 ; highest, 92 ; lowest, 64. Total rain-fall, 4.34. Prevailing wind, S.S.W ; number of miles travelled, 3,816.

August : Barometer, monthly mean, 30.03 ; highest, 30.28 ; lowest, 29.86. Mean monthly thermometer, 75.3 ; highest, 90 ; lowest, 66. Total rain-fall, 2.87. Prevailing wind, S.W. Maximum velocity, fifty miles per hour. Six rainy days.

September : Mean monthly barometer, 30.07 ; highest, 30.27 ; lowest, 29.80. Mean thermometer, 68.6 ; highest, 91 ; lowest, 50. Total rain-fall, 3.79. Prevailing wind, E.S.E. ; number of miles travelled, 3,989 ; maximum velocity, sixty miles per hour ; number of cloudy days, four ; rainy days, four.

The above statistics are taken from reports of the observer in the Signal Service, U. S. A., stationed at Knoxville.

In June, up to the date of the occurrence of the first case reported above, the wind had been southerly, but mostly southwest. The weather during the first half of June was warm and sultry. The mean daily thermometer from June 1 to June 15, was 68° the lowest, and 79° the highest. On the 23d it was cloudy; mercury mean for the day, 76°. Up to the close of June there was no abatement of heat. The highest mean was 81° on the 25th. In July, from 1st to 12th, the wind was southerly most of the time; at times it would veer to the north, northeast, or northwest for a few hours, and again change to south. The weather became hotter, and on the 4th the daily mean was 83°. Nine days out of the twelve were fair, which means that the sun was burning hot. On the 5th there was a heavy rain, with wind E. S. E. to N. E. It was during this period that the disease was raging on Water Street. Up to the 25th there was a steady occurrence of cases, with hot and dry weather, southerly winds, inclining to west.

From this time till about August 15, there was a partial cessation, when the disease made its appearance on the banks of Second Creek. For about ten days the wind was southerly, occasionally changing for a few hours only to return with its hot breezes from gulfward. The weather during the last half of August was more cloudy than in some corresponding periods in June and July. Daily mean of mercury was about 75°. There was a sultry air and every one complained of a feeling of languor and lassitude very unusual here in summer. It seemed as if there was something in the air which caused faintness. From August 20 to September 10, the wind was southerly, changing between southeast and southwest. Five times only did it change to the north, and there remained but a short time. The sun shone very intensely, and the breezes were void of anything refreshing.

CHOLERA IN CINCINNATI, OHIO.

By J. J. QUINN, M. D.,

Health Officer of Cincinnati.

The fourteenth of June, the day upon which the first fatal case of cholera is reported to have occurred, found Cincinnati, it is believed, in as favorable sanitary condition as most of the large cities of the country. Nuisances there were in the city, which it had been found impractical to remove; they were, however, for the most part, remote from dwelling-houses, and their pernicious effect on the public health has not been very clearly demonstrated, though there can be little doubt they had an injurious influence.

Mortality in the City preceding the Epidemic. — Cholera had made its appearance in New Orleans in the previous February, and had been prevailing in different parts of the Southern States; and although it was not entirely unexpected in Cincinnati, no unusual amount of sickness, nor the prevalence of a particular type of disease, gave premonition of its approach. Besides its natural and ordinary growth, the population of the city had been increased by the extension of the corporate limits, on February 1st, over territory containing about one thousand three hundred and fifty, by the annexation, on March 18, of an additional ward containing about five thousand, and by the accession, on June 9, of territory containing about one thousand one hundred and fifty inhabitants. Notwithstanding this, there seems to have been little difference between the mortality immediately preceding the appearance of cholera, and that of the corresponding period of previous years: not so much even, as often occurred in the respective mortalities of particular periods of other years. Without the aid of any epidemic influence, great difference in the percentage of mortality is often found in the corresponding periods of different years.

During the first three days of June, the mortality in these years were, in: —

	1871.	1872.	1873.
Deaths	33	47	36
Still-born	3	5	3
Total	36	52	39

There were also in this period, for 1872, ten deaths from small-pox. Deducting, however, the deaths from small-pox which occurred in each of the three years, the mortality from all other causes was thirty-two in 1871; thirty-seven in 1872; and thirty-five in 1873.

These statistics show the mortality immediately preceding the beginning of my administration as health officer, June 4, to have been about the same

as in previous years, making allowance for increase of population, prevalence of small-pox, and other ordinary circumstances. A comparison of the first ten days of my term of office, or until the appearance of cholera on the 14th of June, with the corresponding days of the two preceding years, reveals a greater difference in the mortality, but not against the present year. The mortality was: —

From June 4, to June 13, inclusive: —

	1871.	1872.	1873.
Deaths	135	108	117
Still-born	6	9	10
Total	141	117	127

From these facts it must be evident that no unusual number of fatal cases of disease gave warning of the advent of cholera. There being no record of non-fatal cases of sickness kept in the city, except of those treated in public institutions, and those which occurred among the out-door poor, it is impossible to make a comparison of the whole amount of sickness prevailing in this period of 1873 with that of previous years; but from all the data that can be obtained, it would appear that the general health of the city was at least as good as in former years.

What was true of fatal cases of disease in general, was equally true of each particular cause of death. The prevalence of no particular form of disease foreshadowed the coming of cholera.

First infected Steamboat from a Cholera District. — Although constant communication by river and railroad had been kept up from the first appearance of cholera in the South, between infected districts and Cincinnati, the first reported death from the disease took place, as already stated, on the 14th of June. It is proper to go back of that date and inquire whether the disease had been imported or developed in the city previous to that time.

The steamboat *John Kilgour* left New Orleans, where cholera was prevailing, on May 13, and landed at this city May 23, having had three deaths from cholera on board during the trip. From this it has been claimed that the cholera of 1873, in Cincinnati, dates with the 23d of May. I will therefore confine my present inquiries to the period following that date, although my investigations of the subject have extended beyond that time, with, however, the same result.

Cholera made its appearance on the *John Kilgour* upon the second day after she left New Orleans. The first victim was Mr. John Schenck, a prominent citizen of this county, who died about forty miles above Vicksburg; the second was a deck passenger, who died about fifty miles above Cairo, on the Ohio River, and was buried soon after death; the third, who was also a deck passenger, died twenty-five to thirty miles below Evansville, Ind., and was buried at Rome, one hundred miles below Louisville. The steamer was well washed and scrubbed several times afterwards; the staterooms were thrown and kept open for full and free ventilation, and the whole boat was thoroughly disinfected — different agents having been obtained at Evansville for that purpose.

No person had any symptom of cholera on the voyage, except those who died. All the deck passengers left the boat at Louisville. The captain was acquainted, and subsequently met and conversed with many of the cabin passengers; he knew all the officers and crew; and neither he nor the other officers have heard of a single person on board having had any symptom of cholera after the trip.

The remains of Mr. Schenck were placed in an air-tight casket, at Greeneville, Tenn., about ninety miles from the place of death, and forwarded from Memphis, by rail, in charge of Adams' Express, to Cincinnati. From Cincinnati they were taken to the late residence of the deceased, about nine miles from the city, thence to the cemetery, one and a half miles distant, without being removed from the hearse, and deposited in their final resting-place before the performing of the religious ceremonies, which took place in the adjoining church, after the interment. The casket was never opened after it had been hermetically sealed at Greeneville, one thousand miles from Cincinnati. Mr. Schenck left a widow and ten children. None of the family has since had cholera or anything resembling it; neither has any one of over one hundred persons who attended the funeral; nor has there been a death from cholera, nearer than Carthage, a village some three or four miles distant, across the country, and on a direct road from the city, in a different direction. No case occurred outside of the city, on the road to the residence of the deceased, over which the funeral cortege passed; and no case occurring in the city since, can be traced to the *John Kilgour*, to anybody on board, or to anything connected with the vessel.

If this boat brought the disease to Cincinnati, we might expect to find some of the first cases developed in the city among its passengers, officers, or crew; among some of the friends or acquaintances visited by them, or among persons having some intercourse with the boat. Or, if the disease had been at first overlooked as genuine cholera, we might expect the first fatal cases pronounced diarrhœal affections, in some manner connected with the boat, or with some article carried by her from an infected district. What was the fact?

Cholera Morbus. — The first death reported from any diarrhœal cause, after the arrival of the *John Kilgour*, took place at No. 1,327 East Front Street, on the 26th of May. This was a case of diarrhœa, in a child four months old, and will be referred to again. The second occurred in the Cincinnati Hospital, on May the 27th. The case was reported in the certificate of death, by the attending physician, as cholera morbus; duration of the illness, six days. The attack, therefore, commenced two days before the *Kilgour* arrived at the wharf.

The patient was a stranger in the city, a farmer from the extreme eastern part of Kentucky, where no cholera had then, or has since prevailed; nor did his course to Cincinnati lay through any cholera-infected locality. It is not unusual for persons from the country, especially in the early part of the warm season, when the use of new vegetables has just been commenced, to experience, from change of diet, water, or other cause, more or less disturbance of the bowels. Soon after his arrival, this visitor was seized with

diarrhœa, and taken, May 22, to the Cincinnati Hospital. When admitted, he was, the record says, "bleeding some at the nose." On the 23d, he had light colored stools; on the 24th, his stools were dark colored; on the 25th, they were tinged green; on the 26th, there was little diarrhœa; on the 27th, he was seized with convulsions, in which he died. The duration of his illness was recorded as six days, his residence in the city as one week. His death, as already marked, was returned to the Health Office, with the certificate of the physician, as cholera morbus; and certainly the epistaxis and convulsions would not point it out as a case of genuine Asiatic cholera.

The next case reported as cholera morbus, which proved fatal, occurred in the practice of Dr. George E. Walton, died May 12, also in convulsions, and had, besides, sanguinious discharges from the bowels. The patient was a child, twenty months old, living with its parents at No. 237 Longworth Street, in a high and healthy neighborhood. The parents had not been near any person or thing associated with cholera. This child's illness lasted only twenty hours.

Some physicians might hesitate to pronounce a diagnosis of first cholera cases, on account of the doubt and incredulity that might be entertained by members of the medical profession, until the presence of the disease was well established and generally acknowledged. It would be difficult, however, to show that these two, which were the only cases reported as cholera morbus until June 16, should have been diagnosed true Asiatic cholera. And if they should be so pronounced, it would not be very evident that they were either imported or contracted from an imported case.

Cholera Infantum. — The first death from cholera infantum, after the 23d of May, occurred May 30, after three days' illness. The patient was a child, two months old, living on York Street, a distance of 6,650 feet, or more than a mile and a quarter, in a direct line, from the nearest railroad depot, and 9,800 feet, or nearly two miles, from any steamboat landing. On the same day, at No. 510 West Fifth Street, a distance of 6,950 feet, one and one-third miles from the first case, five squares from the nearest southern railroad depot, and 6,200 feet, or more than a mile from the wharf, at which the *John Kilgour* landed, the second death from this disease took place. The patient was a child, seven months old, and died after four days' sickness. The third death occurred June 4, at No. 21 Park Street, four squares from the last case, 5,000 feet, or nearly one mile, from the steamboat landing, and one square from the Ohio and Mississippi Railroad depot. The child was two days old, and two days sick. On the same day, after an illness of five days, the fourth fatal case took place at No. 117 Betts Street, 2,500 feet, or nearly half a mile, from the nearest death mentioned above, 6,000 feet from the Ohio and Mississippi depot, and 8,000 from the public landing. The patient was two months old. The fifth death from cholera infantum took place at the Burnet House, on June 6; the child was six months old, one day sick, and only one day in the city from the South.

This was the first patient attacked with any diarrhœal disease, who had come from a suspected district. No case of cholera, or of any from diarrhœal disease, occurred subsequently, nearer the Burnet House than two

and a half squares. That case was one of cholera, and died at the Henrie House, nearly a month later; and no connection could be established between it and the Burnet House case of cholera infantum.

The sixth fatal case of cholera infantum occurred more than four miles from the river; death took place June 7; age of the child, seven months. On June 8, the seventh case, aged ten months, died on Liberty Street, after three days' illness. The nearest previous death to this, from diarrhœal causes, was about ten squares distant. At No. 337 Walnut Street, and on June 11, the eighth case died; age, one year; duration of illness, two days; several squares distant from the last mentioned case, and 8,500 feet from the river. The ninth case of cholera infantum, or the last which terminated fatally, between the 23d of May and 14th of June, died June 13; age eleven months; duration of attack, three days; residence, No. 79 Dayton Street.

With the exception of the patient at the Burnet House, these children were all natives of the city. The parents of one had no acquaintance or communication with those of any of the others, and their homes were, for the most part, at widely separated points. The two cases nearest to each other were the first and last, and they were about two squares apart.

Distances used in giving the topographical relation of the above cases, as well as those which will be employed hereafter, have been taken from the large graduated map of Cincinnati, in the office of the City Civil Engineer. The measurements were not made along the lines of the streets, but directly from point to point upon the map, no allowance being made for elevations and depressions, or for the obstruction, from houses, to wind and travel. They are therefore shorter than the space required to convey a portable article from one of the localities to another.

It would be difficult to discover anything in the reports of these cases showing they were not what they were represented to be. Nor would it be easier to find any characteristic symptom of cholera in the following reported cases of diarrhœa during this period. The first fatal case of diarrhœa, referred to above, occurred on East Front Street, 9,000 feet in a direct line (15,000 feet, or nearly three miles by the line of travel on either road or river) from the public landing; and 6,800 feet in a direct course from the nearest railroad depot, or 11,600 feet by the line of street. The patient was a child four months old; duration of attack, twenty-four hours; date of death, May 26. The second fatal case was also a child, four months old, who died May 31, after ten days' sickness, at 180 West Third Street; distant directly west from the first case, 11,500 feet, or more than two miles, and more than four miles by the line of travel. The third occurred on Mt. Adams, at a point (midway between these two cases) 3,500 feet from and 340 feet above the level of the Ohio River. This child was nine months old, and three weeks sick. The fourth case was three months old, twenty-four hours sick, and died June 10, on Vine Street above Liberty, formerly the northern boundary of the corporation, and still north of the densely populated portion of the city. This case occurred 9,000 feet, or more than one and a half miles from the river.

Three fatal cases of chronic diarrhœa were reported during this time, only

one of which was an adult. The first was a female, twenty-one years of age, who had suffered under the disease four months; another was a child, who had diarrhœa from birth; the third was a child, nine months old, the last third of whose life was a prey to the disease. None of these cases was located near any of those mentioned above. It may be added that, as in the cases of cholera infantum, none of the families in which death took place from diarrhœa had any acquaintance or intercourse with the others.

Does any one find in these deaths from diarrhœal causes any evidence of true Asiatic cholera? Is it more creditable to the professional reputation of the medical man to lose a case of cholera morbus, than one of cholera? A review of these cases does not, in my opinion, prove any of them to have been cholera. They were not in groups, were in separate localities, and had no association with each other. No case of cholera occurred in the Cincinnati Hospital for twenty-two days after the death from cholera morbus, and then it was taken to the Hospital from No. 489 Walnut Street. Seven fatal cases of acknowledged cholera had at that time taken place in the city. No connection has been traced between the fatal cases of cholera morbus, cholera infantum, and diarrhœa, before the fourteenth of June, and subsequent cases of cholera.

There were probably cases of cholera occurring at a later period, which, from the absence of some well marked symptom or symptoms, were set down to kindred diseases. These occurrences, however, took place after, not before, the acknowledged appearance of the epidemic. It so happened that the first fatal cases of true cholera fell into the hands of physicians who recognized the disease and gave it, in their certificates of death, its true name. From these cases the manner in which the epidemic entered the city cannot be traced. Had it been possible to have obtained a history of all the cases, those that recovered as well as those that died, the introduction of the disease might possibly have been traced through their history. But even if this could have been done, it would be difficult to trace the first fatal case to any important cause; and the mode of propagation afterward would still have remained a mystery. No two cases occurred in the same block, or had any connection with each other, with the exception of a single instance, in which father and child died in the same house upon the same day, until sixteen deaths from cholera were reported in widely separated parts of the city.

First Cases of Cholera. — These facts show pretty clearly that Cincinnati was not only free from any unusual severity in ordinary diarrhœal affections, but was in the enjoyment of its usual health when the first case of cholera was reported. The certificate of death gave the name of Philatine Gundlock; age, forty-five years; widow; residence, 57 Oliver Street; residence in the city, twenty years; previous residence, Germany; duration of last illness, twenty hours.

Case No. 1. — The patient was a widow with three children, two boys and one girl; the eldest, a boy, fourteen or fifteen years of age. They occupied the rear room, sixteen by sixteen feet, on the ground floor of a three-story brick tenement house, in a tolerably clean and rather sparsely

inhabited neighborhood. Three families, consisting of twelve persons, occupied the house. It was well provided with windows in front, rear, and on the east side, along which there was an entrance to the yard. The yard itself was clean, the vault in good condition and free from offensive odor, and the immediate sanitary surroundings were more free from objections than most tenement houses. There was, however, at the distance of about a square, in a direct line, but with intervening houses, a number of small stagnant pools, formed in the old vats of an abandoned tan-yard.

This house had been the residence of the woman for more than a year. She, with her children, worked at chair caning in her own room. She had not been out of the city, seldom out of her own house; her children performing the necessary errands, and carrying her work to and fro. No visitors had been received by her from abroad, nor had she been in contact, as far as could be learned, with anything connected with cholera.

Case No. 2. — Early on the 15th of June, the day following the death of this case, but before it was reported to the Health Office, Prof. Jas. T. Whittaker, editor of the "Clinic," reported a case of cholera, to which he had been called that morning, before daylight, and which had also been seen by Professors Bartholow and Connor. The patient lived at No. 55 West Seventh Street, one of the most cleanly and healthy parts of the city, the abode of persons in easy or comfortable circumstances, situated upon a bed of gravel, which thoroughly drains and dries the ground upon which the houses are built. He was a merchant, married, aged fifty-six years, born in Pennsylvania, and had removed to the city more than a year before the attack. His premises were also visited; the house was well ventilated, the yard clean, the vault of considerable depth to the surface of its contents. and free from noisome smell, and the surroundings good, except a slight defect in the yard drainage. It was learned from the widow, that the husband had not been out of the city during his residence in it. No stranger or friend from abroad had visited the family, nor had any person from other houses in the city, in which there had been any similar disease, called at the dwelling. He died about five P. M. of June 15; the duration of the attack being set down as twenty-two hours, and the disease as sporadic cholera.

Case No. 3. — The third case was taken on the night of the day on which this patient died. On the following morning, June 16, Dr. W. T. Brown was called, and diagnosticated it cholera. This patient had the rice water evacuations, husky voice, dark skin, corrugated fingers, profuse clammy perspiration, cold breath, suppressed secretion of urine, and all the well marked symptoms of true Asiatic cholera. Death took place the same day, after only twelve hours' sickness. The patient was a married man, aged forty-five years, a laborer, and of irregular habits of life. He had resided in the city eight months, and had removed here from Baltimore.

Notwithstanding these dangerous circumstances, there was no other death from cholera afterward in the immediate vicinity west, nor nearer in that direction than three quarters of a mile beyond the creek and cattle pens. East and northeast of it there occurred, subsequently, six deaths, at radii varying from 1,500 to 2,250 feet.

Case No. 4. — Julia Ann Bowman, colored, widow, aged fifty-four years, born in Kentucky; residence, 130 L'Hommedieu Alley; lived in the city three months; duration of last illness, eighteen hours; died June 16, of sporadic cholera.

Like the others, this patient had not been in contact with any person from an infected district.

Case No. 5. — On the morning of the same day, a colored woman, aged thirty-nine years, was attacked at No. 531 West Fifth Street. She was attended by Dr. J. P. Walker, and lived until the next day, June 17. This was the fifth case reported. The attack lasted thirty-six hours, and gave promise at one time of reaction. This patient, with her husband and two children, occupied three rooms on the ground floor of a three-story brick building, in the middle one of which she died.

Case No. 6. — Dr. C. S. Muscroft reported the sixth fatal case. Death occurred June 17, after only nine hours' sickness. The patient was a married woman, with two children, aged twenty-eight years, in the city seventeen months, and occupied for the three months preceding her death, two rooms on the first floor of a two-story frame house, No. 45 Elizabeth Street. Two other families, consisting of nine persons, lived in the same house. The yard was free from rubbish and dirt; the vault was seven feet deep, but foul; the neighborhood was clean; and the street not in any ordinary line of travel between any of the localities where the other deaths had occurred.

Case No. 7. — The seventh fatal case was a married man, aged forty-four years, in the city six years; died June 18, at No. 451 West Third Street, where he had resided for a year.

Case No. 8. — A widow, thirty-seven years of age, was the eighth reported victim to the disease. She was a washerwoman; lived at No. 489 Walnut Street; was taken sick while washing in a private family, on Main Street; and died in the Cincinnati Hospital, June 18.

Case No. 9. — On June 19, the ninth death reported from cholera occurred at No. 55 Pendleton Street. Nine families, including the patient and wife, twenty-three persons in all, occupied the house, which was a three-story brick. The vault was full and foul, and the premises in bad sanitary condition. The neighborhood was clean, and afforded good facilities for ventilation.

Case No. 10. — Before the death of the last three persons, a female twenty-three years of age, living at the southwest corner of Eighth Street and Central Avenue, was reported laboring under the disease. The patient was under the charge of Dr. J. Cilley, and lived until June 19, being the tenth death reported from the disease.

Cases No. 11 *and* 12. — Besides the last two cases, four other deaths from cholera were reported on the 19th of June. Two of these, father and child, took place at No. 160 Hamilton Road. The family consisted of husband, wife, and two children, and occupied the rear room of the second story of a small two-story brick house. The husband was first attacked with the disease. He had suffered from diarrhœa for two weeks, drank a quantity of cold wine on the 17th, was taken sick the same day, and died the second

day following. The child, eighteen months old, was taken about the time of the father's death, and died in two hours. The room occupied was about sixteen feet square, with two windows looking toward the north, and one overlooking a narrow passage-way on the east.

Case No. 13. — The next reported case died in the Cincinnati Hospital, and was taken there from No. 152 West Front Street. The patient was an old man, sixty years of age; lived in the city five months; duration of illness, twenty-four hours.

Case No. 14. — The fourteenth patient, whose case terminated fatally, died on the 19th. He was a boy, three years old, and died after twelve hours' sickness, in a three-story brick tenement house, containing eight families and fifty persons, at No. 502 Elm Street.

These cases occurred during the first six days of the epidemic, and are mentioned somewhat in detail, because they were the first fatal cases reported. Little could be learned, at the time of death, of the eleventh and twelfth cases, and as the widow with the surviving child soon afterward returned to Germany, nothing could be learned since. It is known, however, that the father had suffered from diarrhœa for two weeks before the cholera symptoms set in, and that these had followed the use of sour wine. The habits of the thirteenth patient, who lived in a boarding-house with bad sanitary surroundings, could not be ascertained; an overcrowded tenement house was the home of the last case mentioned. It is not known upon what diet the child had fed.

In the suburbs, beyond the hills, the disease did not seem to spread. At Carthage, seven miles from the city, but in the valley of Mill Creek, there were several deaths from it.

In the portion of the city north of the Miami Canal, where the mortality was greatest, the tenement houses were numerous, and the population dense. The parts below the canal, on the contrary, where the locations of deaths were closest, contained comparatively few tenements, though the houses were compactly built. The cluster of deaths, near the junction of Broadway and the public landing, was in the neighborhood of a row of damp, unclean buildings, fronting on the river, the resort of the lowest class of boatmen of all colors, and the scene of debauchery by day and night. With comparatively few exceptions, no relation could be traced between cases; and when an apparent connection existed, it might, in most instances, be fairly attributed to a common proximate cause.

It is also proper to state, that in no instance did a death from cholera occur at a greater elevation above low water mark in the Ohio River than one hundred and seventy-five feet, and few fatal cases occurred at a higher altitude than one hundred and fifteen feet. Low water mark in the Ohio River, at Cincinnati, is four hundred and thirty and a half feet above tide water in the gulf.

The total deaths reported from cholera were two hundred and seven, distributed as follows: —

In hospitals, previous histories of patients and places where attacked not known	22
In different parts of the city, residences not found	8
In hotels	1
In private residences	34
In tenement and boarding-houses	142
Total	207

Few of the patients who died in hospitals could be traced to their homes. Some were non-residents, taken from steamboats; some had no fixed or permanent homes; and others were boarders in the different parts of the city, little of whose histories could be learned. It was ascertained, however, that three of them had been in previous ill health, two others had been imprudent in the use of intoxicating liquors, and one imprudent in diet. In addition to these, two labored under great mental excitement, and dread of the disease, before their attack. It was also known that all were members of different families.

Cases were reported on sparsely built streets, in houses not numbered, and some were returned with the wrong name of the patient, or the wrong number of residence. There were eight of these, four within and four without the boundaries of the map, the sanitary condition of whose homes, and whose habits of life and history of attacks, could not be learned. No two of them, however, belonged to the same family. There were also seven other cases, whose residence, though examined and included in the following table, cannot be indicated upon the map, in consequence of its partial boundaries.

A youth, fourteen years of age, died in one of our large hotels. He had been attending school in the city, though his home was in another part of the State, and no exciting cause could be discovered to account for the attack. The hotel was clean, excellent in its appointments, and well kept. No other death from cholera was reported in this, or any other hotel in the city. No deaths from the epidemic were reported in the city subsequent to October 18.

Multiple cases in Private Residences.—The first multiple cases in private residences, were the one hundred and thirty-seventh and one hundred and forty-second fatal cases that occurred in the city. One of the patients was a lady from Newport, Kentucky, who had merely visited her sister for the purpose of spending the day. She had just recovered from an attack of cholera at her own home, and was laboring under diarrhœa in the forenoon of the day of her visit. She ate, however, a hearty dinner of plain food, was seized with vomiting two hours later, and died next day, July 9, the duration of the attack being twenty hours. Her son was unexpectedly summoned to her bedside, labored under great excitement, and became very much exhausted from attendance upon his mother. His death took place July 10, after twenty-six hours' illness. The sanitary condition of the premises and surroundings was good.

The other multiple cases in a private residence are marked on the map, 175 and 177, those numbers indicating the order of their occurrence. Both patients were children, aged, respectively, four and seven years.

The first died August 2, after six, and the second August 3, after eight hours' illness. Nothing which might be considered as the proximate cause of the disease could at first be discovered. The family lived comfortably, in a clean and healthy part of the city; great prudence had been exercised in directing and regulating the habits and diet of its members; the house itself was well arranged for ventilation, and in excellent sanitary condition.

Deaths in Tenement and Boarding Houses. — 142 persons died of cholera in 131 families, who lived in 131 different tenement or boarding-houses. The houses contained in all, 734 families, numbering 2,918 members. 122 of the patients were members of the same number of families, and lived in houses in each of which only one fatal case occurred. These 122 families numbered 438 persons, and occupied 216 rooms. The houses were also occupied by 658 other families, consisting of 2,292 persons. 49 of these houses had favorable surroundings; of 75, the vaults were full or foul, the premises unclean, or the surroundings bad.

Multiple Cases in Tenements. — 20 of the 142 patients who died in tenement boarding-houses, were members of 9 families, 7 families having 2, and 2 families having 3 deaths each. These families consisted of 44 persons, lived in 9 different houses, and occupied 18 rooms. The same houses were occupied by 44 other families, consisting of 185 members, making 53 families of 239 persons in 9 houses. Five of these houses had clean premises and surroundings; the premises or surroundings of the other four were in bad sanitary condition.

Origin of the Cholera of 1873. — In my first monthly report to the Board of Health, June 17, the cholera of 1873, then entering the city, was referred to as probably of domestic origin, from the fact that no evidence had been discovered of its introduction, by vessel, into any of our large seaports. By some, the idea of its non-importation was considered impossible; but the opposite view has been sustained by the health authorities of New Orleans, where the disease first made its appearance. After a full and thorough investigation of the subject, they have established the fact, from the examination of vessels by the medical quarantine officer, from the testimony of captains and physicians of vessels which had arrived at New Orleans, and from careful inquiry into the histories of the first cases, that the disease was not carried into that city by vessel from any foreign port.

Cholera made its appearance in New Orleans about the 9th of February; three fatal cases occurred in that month; sixteen in March; ninety in April. In May, when the mortality from it was greatest, it started upon a northward course of travel, appearing on the 13th and 23d of that month in Vicksburg and Jackson, Miss. It also appeared at Memphis about May 17; at Paducah, May 22; at Chicago, May 24; and at Nashville, May 26. It was at Louisville, June 4; at Mt. Vernon, Ind., June 6; at Greeneville, Tenn., June 11; at Evansville, June 12; at Cincinnati, June 14; at St. Louis, Mo., and Burlington, Iowa, June 20; and at intermediate points at later periods.

Character of the Disease. — The late cholera has been supposed by some

not to have been of the genuine Asiatic type. Some have regarded it as Asiatic cholera, but not as generally characterized by all the prominent symptoms of the disease as in former epidemics. The cases that fell under my own observation, those that recovered as well as those that died, were as well marked as any encountered by me in former epidemics of the disease.

In this report I have attempted no explanation of the manner in which the disease entered the city, or of its modus operandi afterward. It has been thought that cholera was not only an outgrowth of India, but that each succeeding epidemic must spring from the original home of the disease, be there nurtured and matured, and afterward disseminated along lines of travel and trade to distant nations and countries. This seems to have been the case in the past, and if it were to continue so in the future, the constantly increasing telegraphic facilities throughout the world would give warning of its travels, and enable cities and communities to test the prophylactic virtues of disinfectants, and other sanitary measures, which have been recommended for its prevention. But if it be transplanted to, and naturalized in, different countries, less warning can be given of its approach, and less opportunity afforded to impede its march. Should it prove to have become acclimated in our own country, quarantine precautions, now so much relied upon, would become powerless in preventing its dissemination at home, however valuable they might be made in prohibiting its exportation to foreign communities.

CONCLUSIONS.

If conclusions were to be drawn from the local history of the late cholera in Cincinnati, they would be about the following: —

1. The manner in which the specific cholera poison reached Cincinnati, and was disseminated through it, can only be a subject of speculation; but it is reasonably certain that the rice water dejections of patients had nothing whatever to do, either with its introduction or dissemination.

2. When the morbific influence was introduced, it did not locate in a particular spot, and travel successively through different sections, but diffused, or spread itself rapidly over the area containing the greater portion of the population, and which is inclosed on the east, north, and west, by a range of hills, whose average altitude is four hundred and nineteen feet above the level of the Ohio River, at low water mark.

3. On the presumption that the disease was germinal, the germs when present were inert in themselves, and required certain geological and meteorological conditions for their development. The geological conditions were found only in the low and table lands; atmospheric and seasonal changes furnished the meteorological conditions.

4. Even when aroused from a passive state, and endowed with active properties by topographical, atmospheric, and climatic influences, the germs seemed incapable of reproducing cholera, until encouraged by certain physiological or pathological changes in the individual.

5. These physiological or pathological changes were produced through the nervous system by exhaustion, fear, anxiety or other depressing mental

emotion ; through the digestive organs, by imprudence in eating or drinking ; and through the respiratory and circulatory systems, by the inhalation of noxious gases and vapors, or of vitiated and impure air.

6. The epidemic furnished no proofs of contagiousness. Indeed, very few of the cases were at all reconcilable with the theory of contagion, while all of them could be explained in accordance with the foregoing conclusions.

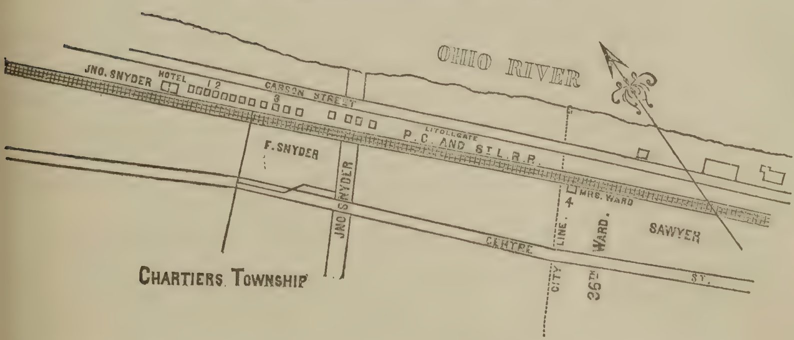
REPORT ON ASIATIC CHOLERA.

By W. SNIVELY,

Physician to Board of Health, Pittsburg.

Case 1. About the 29th day of July, 1873, Mr. Mooney — who was a railroad contractor — and his wife returned home from a visit to Cadiz Junction, Ohio. They resided at a point on the Ohio River, about five hundred yards beyond the city line. Directly in front of the house lies the public road and Ohio River, while a few feet to the rear, and at a considerable elevation above the house, are the tracks o, the P., C., & St. L. R. R.

1. House in which Mrs. Mooney died.
2. House in which Mr. Mooney died.
3. House in which Mr. Lyons died.
4. House in which Mrs. Ward died.



Two days after their arrival home (August 1) Mrs. Mooney, who was four months and a half advanced in pregnancy, was attacked with painless diarrhœa, soon succeeded by vomiting, cramps, suppression of urine, rice water discharges, clammy skin, shriveled extremities, etc., the case terminating in death Monday morning, August 4, at eight o'clock, A. M. The physicians in attendance, although disposed to consider the case one of Asiatic cholera, did not report it to the Board of Health, as it occurred beyond the limits of the city.

Case 2. Monday evening (August 4) Mr. Mooney was suffering from diarrhœa, and was prescribed an opiate by his physician. Tuesday morning he felt better, and visited the city for the purpose of making arrangements for the burial of his wife. While in the city he became very ill, and called on his physician, who prescribed for him, and ordered him to go home and to bed immediately. He did so, continuing to grow worse, suffering from the same train of symptoms described in the previous case. Tuesday night he sank rapidly, and Wednesday morning was in collapse. He died at half-past five

o'clock, P. M. During his illness he was visited by a number of physicians, all of whom (skeptical before seeing the case) concurred in pronouncing it Asiatic cholera.

Case 3. Mary Ward, married, age forty years. Mrs. Ward resided in a small frame house which stands about five yards within the city line, and about five hundred yards from the house where the former cases occurred. Mrs. Ward, who had always enjoyed good health, was with Mrs. Mooney at the time of her death, and assisted in the performance of various duties, remaining in the room probably an hour altogether. This was her only visit to the house.

Two days after, Mrs. Ward was attacked with diarrhœa, rapidly succeeded by all the symptoms observed in the two former cases. She died Thursday, August 6, at eight o'clock, P. M.

Case 4. James Lyons, single, age twenty-five years. He worked in an iron mill, and had never been sick in his life. He assisted the "Sanitary Inspectors" to burn the bedding, carpets, etc., at Mr. Mooney's house, on Wednesday evening. He was attacked with painless diarrhœa on Friday, August 8. The preliminary diarrhœa was soon succeeded by violent cramps of the muscles, particularly those of the extremities. Slight vomiting of a clear, watery fluid, containing no bile. Rice water discharges not so copious as in the former cases. There is suppression of urine, intense thirst, and marked restlessness. Pulse weak, but natural in frequency. Tongue foul, face and extremities cold, breath and tongue warm. Whole surface changing in appearance. Skin from middle joints of fingers to tips, inelastic, shriveled, and of a bluish tinge. Intellectual faculties unimpaired. There is slight disposition to stupor, but he is easily aroused, and converses sensibly and intelligently. Temperature in axilla, 99° Far.

The vomiting, cramps, and evacuations gradually cease, and the voice begins to get husky; greater tendency to stupor; pulse becomes fluttering, thready, very difficult to count. Whole surface covered with clammy perspiration. Temperature 99°.

The respiration becomes feebler, the breath and tongue cold, the voice lost, and the pulse imperceptible; only a feeble, oscillatory movement of the heart being perceptible upon auscultation. Temperature $99\frac{2}{5}°$.

He died at one o'clock, P. M., Sunday, August 10. Temperature of body, two hours after death, $97\frac{4}{5}°$.

The duration of the disease in the first case (Mrs. Mooney) was about seventy-two hours. In the second case (Mr. Mooney) about forty-six hours. In the third case (Mrs. Ward) about twenty-four hours. In the fourth case (Mr. Lyons) about forty hours.

These four cases terminating fatally in rapid succession, occurring at this isolated point on the city line, and originally traceable to Mr. and Mrs. Mooney's visit to Cadiz Junction at a time when Asiatic cholera was reported as prevailing there, seems to me (in the absence of any local cause) sufficient to establish the nature of the disease. That it did not become epidemic, is due to several causes. 1. The remoteness of the locality from the populous portions of the city, rendering isolation easy. 2. The immediate

disinfection (by carbolic acid, sulphate of iron, etc.) and destruction (by fire) of everything (evacuations, bedding, carpets, clothing, etc.) likely to convey infection.

We have had in Pittsburg this season about the usual number of cases of cholera morbus. Fourteen deaths from this cause were reported during the months of July, August, and September. The *cause* of this disease was generally traceable to error in diet, exposure to cold, etc. The cases generally recovered, unless suffering from some vice of constitution. No particular sanitary precautions were taken with regard to this disease, and in no instance was there any evidence of *contagion*.

LOCAL MEASURES OF PREVENTION AND RELIEF

TO BE ADOPTED DURING THE PREVALENCE OF EPIDEMIC CHOLERA.

By STEPHEN SMITH, M. D.,
Of New York.

An eminent writer has observed that "cholera should not be treated as a disease, but as a pestilence." The truth of this remark becomes more and more apparent with every succeeding epidemic. All our efforts to control it by the well appointed agencies which are applied efficaciously against ordinary diseases have proved, for the most part, unavailing. To control its progress, to mitigate its severity, and to avert its attacks, we must resort to special measures, and apply them with promptness and precision.

In order to a proper appreciation of this subject, we have to inquire, 1st, What are the lessons which the past epidemic visitations have taught us? and 2d, How are these lessons to be applied?

1. Cholera epidemics have taught us that cholera is almost invariably preceded by a diarrhœa. This diarrhœa is generally painless in its character, and precedes the stage of collapse for a variable period, often continuing for days.

Diarrhœal diseases also prevail over large tracts of country, preceding or accompanying cholera. In 1832 an enormous amount of diarrhœa occurred in the towns of Europe which were visited with cholera. In 1849, in all the towns of England attacked by cholera, diarrhœa prevailed to a remarkable extent; in Glasgow, during the height of the epidemic, nearly the whole population was affected. The same remark applies to the towns of this country visited by the pestilence.

2. They have taught us that the special importance to be attached to this diarrhœa, during the prevalence of the epidemic, is its liability to terminate in fully developed cholera; in other words, that it is the premonitory stage of cholera. The English Board of Health states as the unanimous conclusion of large numbers of medical men in 1849, that "whenever diarrhœa prevails extensively in a country and district where cholera is epidemic, diarrhœa is premonitory of cholera; that it is not a mere coincident or concomitant; that it is not even merely a predisposing condition, but is actually part and parcel of the disease, not to be distinguished from the actual commencement of the most severe form of the malady."

3. They have taught us that this painless diarrhœa rarely excites apprehension. This is known to be true, even where the victim is a well-informed physician. Mr. Aston Key, then one of the most brilliant surgeons of Lon-

don, lost his life in 1849 by persistent neglect of the premonitory stage. Dr. Cooper, long Health Officer of Southampton, England, during the slight epidemic of last fall in that town, was continually urging the people to promptly attend to attacks of diarrhœa; and yet, at a dinner party, he informed a medical friend that he had suffered from a mild diarrhœa for several days. On being remonstrated with for his neglect of himself, he declined treatment, and the diarrhœa soon passed into fully developed cholera, and he died. If even physicians are thus indifferent, what must be the apathy of the laboring classes? All observers agree that it amounts to the most reckless carelessness.

Dr. Sutherland, also an inspector of the General Board of Health in 1849, and who consequently had a large field of observation, reports: "A very ample experience has convinced me that those who are in the most danger are least likely to apply, because there is a state of the nervous system connected with a severe epidemic seizure, the tendency of which is to make the sufferer apathetic. The sentient nerves are dulled, and important constitutional changes take place without pain. The discharges which are sapping the very powers of life are permitted to go on, not only without check, but with a certain consent to the feelings of relief which are experienced. No alarm is taken till it is too late; and, in not a few instances, the relatives have been first aroused to a sense of danger by the last death struggle of the patient; it has likewise happened that the medical visitor, in going his rounds to seek out cases of diarrhœa, has found the dead bodies of those for whom no medical aid has been sought or procured. Fifty-one such examples occurred in one parish in Glasgow alone." He adds: "It has been found by melancholy experience, both in Dumfries and Glasgow, that neither rich nor poor will, of their own accord, apply for medical aid, until the time for its effectual exercise is either past, or the chances of recovery reduced to a very small proportion. The premonitory disease, in a large number of persons, is attended with sensations rather agreeable than otherwise; the sufferer is lulled into a fatal security, and no alarm is taken till it is too late."

4. We have learned that the premonitory diarrhœa is very curable. Statistical inquiries show, that not far from ninety-nine per cent. of the cases of diarrhœa, occurring during a cholera epidemic, recover if properly treated. Of 44,737 cases of diarrhœa treated in several parishes in England, where cholera was raging in 1849, but fifty-two passed into cholera. In several other districts 26,803 cases of diarrhœa were treated, many of which had advanced to the stage of rice-water purging, but eleven terminated in cholera.

5. Finally, we have learned that cholera attacks given insalubrious localities, and does not spread generally over a town. Nor does it attack these centres of filth and overcrowding simultaneously, but rather in succession. After a period, varying from ten to twenty days, the epidemic tendency generally subsides, and the locality may or may not remain free from subsequent attacks.

The following propositions may then be regarded as well established:—

1. That epidemic cholera is almost invariably preceded by a diarrhœa.
2. That this diarrhœa is identical with cholera in its progressive stages.

3. That little or no apprehension is excited by the premonitory diarrhœa, and hence that it is allowed to pass untreated, until it terminates in developed cholera.

4. That this diarrhœa is, in the vast majority of cases, curable.

5. That cholera attacks the most insalubrious localities in succession, and expends its force apparently within two or three weeks.

Taking these facts as our guide, it is not difficult to determine what measures of prevention and relief should be adopted by those bodies having in charge the health of communities during the actual presence of Asiatic cholera, in addition to the prosecution of the proper sanitary works. In the first place, it is evident that the ordinary administration of gratuitous medical relief, through the medium of the dispensaries, will not meet the emergency. The agencies of the dispensaries reach only those who apply for relief, but the victims of cholera do not, as a general thing, make application for relief. Any system, to be effectual, must be aggressive, not passive. It must send its agents to the homes of the people, and by the most systematic and persistent effort search out the pestilence in its incipient stages, and apply the remedy at the bedside. It must be a house-to-house visitation, so thorough as to actually reach every member of the family. We are not left to conjecture that this will prove an effectual preventive measure during the prevalence of cholera. Examples of its adoption and successful prosecution are on record, and deserve our careful consideration. They furnish indubitable proof that if the system of person-to-person or house-to-house visitation be vigorously prosecuted, and all the premonitory cases be found out and treated, the epidemic, however severely it may be raging, is positively under the control of the local authorities.

HOUSE-TO-HOUSE VISITATION.

It is well worthy of notice that the plan of searching out the premonitory cases and promptly treating them was adopted at Bellevue Hospital, then (1832) under the superintendency of one of the most judicious practitioners of the city, Dr. Isaac Wood. So promptly was the epidemic suppressed in that institution by this measure, that the circumstance attracted the attention of the Board of Health, and a committee was appointed to report the facts in the case. The Committee states, "That the medical officers of the Bellevue establishment, in all its departments, have taken the most efficacious measures, as well as most fortunate in their results, for enforcing among all the persons under their charge an undeviating attention to the recommendation so earnestly enjoined by the Special Medical Council, of making known, at the first onset, the forewarning symptoms of cholera, and of obtaining immediate medical assistance. . . . No longer confiding to the inmates of the Bellevue establishment the care of reporting their own illness, the medical officers themselves go round daily, and question every person individually, and whenever diarrhœa is detected, medical treatment is ordered on the spot. From twenty to thirty such cases are prescribed for each day, and it is the impression of the officers that many of those cases, if neglected, would still pass into cholera. The same medical police is observed on Blackwell's

Island; and the penitentiary prisoners residing there are daily paraded, questioned, examined, and inspected, and if any are found to present the premonitory symptoms, they receive instant medical treatment. . . . Coincident with the strict enforcement of this system, the disease has been seen to decline, and at last to cease. . . . The entire cessation of the disease at Bellevue, without the cause having exhausted itself, in consequence of those measures only of precaution and care which in like manner and in other places and in other hands have been so successful when applied in time, is highly encouraging."

The plan of searching out the premonitory cases was carried out on a very limited scale in this city, in 1849, but with very satisfactory results. The Medical Committee, consisting of Drs. Beck, J. M. Smith, and Moore, state in their report: "The parts of the city where the cholera prevailed was divided into districts, and physicians were appointed to each district for the purpose of visiting the houses of the poor, with the view of ascertaining the existence of disease and affording immediately the necessary relief. The number of physicians appointed to the discharge of this duty was twelve. "The amount of good accomplished by these measures, especially the last, in the way of preventing the development of disease, the committee believes to have been great."

On the approach of the epidemic of 1848–9, the General Board of Health of England, influenced by the success of this example, reduced the whole procedure to a system. This was the first effort in Europe to arrest the progress of cholera by the systematic treatment of its premonitory stages. In giving their reasons for its adoption, the Board of Health remarks: "Satisfied that the connection between diarrhœa and cholera, though so certain and of such vital practical importance, would not be understood by unprofessional persons, and especially by the poorer classes, we were apprehensive that a great loss of life would be the consequence of leaving the poor to themselves until they should of their own accord apply for relief. It appeared to us that it was not sufficient merely to appoint an additional staff of medical officers to be ready to give their assistance when summoned, but that it was necessary to send those officers, provided with the appropriate remedies, into the infected localities, and even to the very houses of the poor, to examine the inhabitants in their own homes and while engaged in their ordinary occupations, and in this manner to commence the treatment of the disease wherever it should be found to exist, before the persons affected were themselves conscious that they were the subjects of it. This seemed to be the only effectual mode of dealing with a pestilence the peculiar character of which is that it runs its moral course in a few hours, and passes wholly beyond the control of human aid and skill unless preventive measures are taken against it in its very earliest stage." "The practical trial of the system of house-to-house visitation," they add, "brought out the evidence of the ignorance and neglect of their perilous condition on the part of all classes, but particularly of the poor, to a larger extent than could have been anticipated."

The objects aimed at by this preventive measure are thus summed up by

Dr. Sutherland, of Glasgow, who perfected the system and carried it into full effect in that city in 1849. They are:—

"1. To prevent persons who might not apply for medical aid, even in cholera, from dying without such aid.

"2. To seek out neglected cases of cholera, so as to bring them under treatment at the earliest possible period, and thus diminish the mortality of the epidemic.

"3. The discovery and immediate treatment of every case of diarrhœa in localities where cholera prevailed, and where the patients had not applied at the dispensaries in order to prevent, as far as possible, the development of the disease.

"4. To keep a constant medical inspection over affected districts and houses, to insure their being preserved in a proper sanitary condition.

"5. To exercise a moral agency over the population by giving such instructions in regard to cleanliness, ventilation, and personal habits as might appear needful, and by explaining and enforcing the necessity for immediate application to the dispensaries or medical officers by all parties who might be taken ill during the intervals between the daily visits."

The following facts illustrate the value of this method of relief: Dumfries, with a population of ten thousand, was the first town in which the experiment was tried. The epidemic seizure was a single one; and all the cases, almost without exception, were preceded by neglected diarrhœa. Before arrangements were made one hundred and forty-seven people had perished, and before the visitation was in full operation two hundred and fifty deaths had occurred. During the three first days, in which it was only partially in use, the fresh attacks daily were respectively 37, 38, 23, and the deaths 9, 6, 9. On the three succeeding days, when it was in full activity, the attacks diminished to 11, 14, 12, and the deaths to 7, 3, 6. On the following three days the attacks sank to 8, 4, 2, and the deaths to 6, 4, 5. In three days more the epidemic was at an end, a few isolated cases only occurring during the succeeding eight or ten days.

Charleston, a suburb of Paisley, was placed under active visitation at a period when the new attacks of cholera amounted to twenty-three daily. On the fourth day after the system was in full operation the attacks fell from twenty-three to three daily, and in a few days more the pestilence ceased.

In Inverness twenty cases of choleraic diarrhœa occurred, ten of which, being neglected, proved fatal; the other ten, being brought under visitation and treatment, all recovered.

In Glasgow 13,039 cases of premonitory diarrhœa were brought under visitation, 1,000 of which had passed to the stage of rice-water purging; yet o the total number but twenty-seven passed into cholera.

In the Shoreditch district, London, there were brought under treatment 21,116 cases of premonitory diarrhœa, 342 cases approaching cholera, and 197 cases of developed cholera; of the number of cases of diarrhœa discovered on visitation only one, and of the cases approaching cholera only two, are known to have passed into cholera.

The conclusions of the Board of Health at the close of the epidemic, in re-

gard to the general and uniform results of the adoption of this system, are thus stated: —

"1. The discovery of a number of dead bodies — the individuals having died of cholera without having received any medical assistance whatever.

2. The discovery of a number of cases of cholera in various stages of development, proceeding with different degrees of rapidity to a fatal termination, not only without medical assistance, but without the slightest apprehension of any danger on the part of either the sufferers or their friends.

3. The discovery of a vast number of cases of diarrhœa, some of them bilious, some with rice-water purging, and others advanced to the stage characterized by serous discharges, without any medicine having been taken, without any alteration having been made in diet, without any thought of sickness, and much less any apprehension of the commencement of a morbid ailment.

4. The application of a great number of persons to the various dispensaries for the immediate and gratuitous supply of medicines, the opening of which in convenient situations formed an essential part of the visitation system.

5. A gradual and progressive diminution of the developed, and an apparent increase of the premonitory cases, the diarrhœa taking the place of cholera.

6. A decided diminution in the number of attacks.

7. A decided diminution in the mortality.

8. Sometimes a rapid cessation of the disease, and invariably a decided and steady progress towards it."

Such are some of the proofs of the value of home visitation when systematically carried out. Many more might be added, but these will suffice.

When the plan was first proposed in England it was received with great skepticism by the community, and even by the medical profession. It was believed that the organization would prove impracticable; but the Board of Health states that "on the actual trial of the system, it proved to be far more easily carried into effect than was at first apprehended. The presumed difficulty of obtaining an adequate number of qualified persons to undertake a work apparently so extensive and dangerous, was never a practical one. Experience has shown that in the most violent and extensive outbreaks of the pestilence, its virulence is invariably confined to circumscribed localities. Even in the districts the most severely attacked, the great bulk of the mortality always occurs within a very limited space, while the disease seldom lasts long at any one point, but attacks a number of points in succession. This is the law of the epidemic. A large staff of visitors, therefore, is not required. A small number, properly organized and directed, are capable of commanding a very extensive district, and may hunt out the disease therein wherever it exists; but this service requires to be performed with all the precision of a military movement." It was also alleged that this system would meet with opposition or indifference from the people, and thus prove impracticable. But the universal testimony of the visitors was to the effect that the poor welcomed them and were very grateful for their services. One

says: "The poor almost universally regard the system of house-to-house visitation as a great boon." Another writes: "They have looked upon our staff as messengers of mercy, and welcomed us with many kind outpourings of grateful hearts; they felt that, though hitherto uncared for in their dire and dreadful calamity, at last the Board of Health has come forward as beneficent guardians of their health, and quieted alarm by efficient preventive measures." Another says: "The medical house-visitation was received with the greatest thankfulness. In the overcrowded districts the poor eagerly told the visitors their complaints, and received the medicines most gratefully. The instructions and advice were eagerly obeyed, and the visits were looked for in future."

The organization of the system of house-to-house visitation is very simple. The agencies selected may be lay or medical. The latter, however, are to be preferred, as they naturally readily become familiar with all the details of the work, and prosecute it with more thoroughness. There is first selected a superintendent; second, such number of assistants as he requires; and third, a corps of visitors. The town is then divided into convenient districts, and an assistant with a proper number of visitors is assigned to each. When cholera appears in any district, or an unusual increase of diarrhœal diseases, the visitors commence their visits. Each carries some simple remedies, and wherever he finds diarrhœa he either treats it, or directs the patients to their physician, and insists upon immediate attention, or, if there is a dispensary, sends them to it. At all events, the diarrhœa is at once put under efficient treatment.

In this connection we may notice the plan of house-to-house visitation adopted by the New York Metropolitan Board of Health, preparatory to the apprehended epidemic of cholera in this district. The basis of the organization was the dispensaries of metropolitan sanitary districts. These dispensaries have long been recognized by the laboring classes as centres of medical relief, and hence during an epidemic visitation of cholera become important auxiliaries to any system of gratuitous aid. Another very important advantage which the dispensaries give is the daily record of the prevailing diarrhœal diseases of the district. This enables the resident physician to determine, in advance of the appearance of cholera, where its foci are to be, and to institute prompt measures of suppression. And if all the dispensaries made daily reports to the Board of Health of the diarrhœal diseases of the day before, there would constantly be at the Central Bureau that degree of information of the epidemic tendency to diarrhœa in all parts of the sanitary district, that would daily indicate the movements of the epidemic, and enable the proper officer to anticipate attacks, and hence ward them off.

There was furnished, therefore, at hand, the groundwork of a most excellent organization for the systematic and complete administration of medical relief. The authorities of the various dispensaries readily assented to the proposition of the Board of Health to coöperate, and the following plan was adopted: —

1. The several chartered dispensaries of the Metropolitan Sanitary Distric

shall be constituted, under the Board of Health, District Centres of Medical Relief.

2. Each Dispensary District shall be divided, from time to time, into as many sub-districts as, in the discretion of the Director of the Medical Relief of the Board of Health, are necessary to the efficient administration of gratuitous medical relief.

3. The following officers shall be appointed by the Board of Health, subject to the approval of the Trustees of the dispensary, namely: 1. A District Director of Medical Relief, who shall have the position of Resident Physician of the dispensary. 2. A District Physician to each of the sub-districts of the dispensary.

4. The officers hereby appointed shall be under the exclusive control of the Board of Health only so far as their duties relate to the special measures of medical relief adopted by said Board.

5. The Board of Health engages to supply the District Physicians with such remedies for immediate administration as the Director of Medical Relief may select.

Proceeding on this basis, the organization of the cities of New York and Brooklyn was perfected. The House Physicians of the dispensaries assumed their duties, and divided their districts into an average of ten sub-districts, and located a physican in each. New York was thus divided into sixty districts. The organization stood thus in New York: —

1. Six Dispensary Districts.
2. Six District Centres of Medical Relief.
3. Six District Directors.
4. Sixty District Physicians.

Although this local force, so judiciously distributed, would seem to be ample for any ordinary epidemic, yet it has been found that the real source of failure is the want of visitors for emergencies. To give, therefore, the greatest possible efficiency to the work, a reserve corps of physicians was organized, which could be detailed in such numbers as might be necessary to meet any given exigency.

The working of the plan would be as follows: "The Resident Physician of the Dispensary would furnish daily reports to the Board of Health of all the diarrhœal diseases of the district, thus enabling the Central Bureau to have cognizance of the epidemic tendency in all parts of the Sanitary District covered by dispensaries. Whenever a case of cholera was reported at a dispensary, the resident physician would immediately direct the physician of the district to visit the house and commence a family visitation, searching out all diarrhœa, and placing it under immediate treatment. If it should happen that there was more diarrhœa than a single physician could properly attend to, the resident physician would call for more, and such a number from the reserve corps would be detailed to aid in the visitation as would effectually place the cholera field under rigid surveillance until the epidemic tendency had subsided.

HOUSES OF REFUGE.

Auxiliary to the work of house-to-house visitation, is the opening of suitable houses for the temporary accommodation of those families which are removed from their apartments for the purposes of cleansing, or because they are unfit for further occupation. In this city the necessity for these establishments during an epidemic of cholera is absolute. Hundreds of families will be found living under such circumstances, and if they are left in their foul apartments, the mortality would be frightful. They must be removed until their dwellings are placed in a good hygienic condition, and then restored to them.

This plan was put in operation in Edinburgh in 1832, with the most satisfactory results. In 1849, it was adopted in many English towns with equally good results. Dr. Sutherland, the agent of the English Board of Health, states that in the severe outbreaks of the pestilence witnessed by him in provincial towns, eighty-seven per cent. of attacks took place in houses where more than one person had suffered from the disease ; and that when the attacks thus occurred in groups in the same or adjoining houses, the danger to the inhabitants was enormously increased by leaving them in their dwellings ; while very few attacks, and scarcely any deaths, took place among these people, if they were removed from the infected locality to houses prepared for their reception, and were kept there in comfort and under observation until their own localities and rooms were cleansed.

An instance strikingly illustrative of the value of Refuges occurred at Bristol, England. During the epidemic of 1832 cholera appeared in a certain lodging-house, and thirty-five persons suffered, of whom thirty-three died. In 1849 cholera again attacked the occupants of this house, but they were immediately removed, sixty-four in all, forty-nine of whom went to the House of Refuge. Out of the entire number removed not a case of cholera occurred, though many suffered from diarrhœa, which was immediately put under treatment. Though the inmates of the House of Refuge were taken from the very foci of cholera, yet the mortality was invariably slight. Out of 270 inmates of the refuge opened in Edinburgh, no cases of cholera occurred. Out of 807 inmates of two refuges in Glasgow, 25 cases occurred, with but 8 deaths ; in Dundee, out of 250 inmates there were 4 attacks, and no death ; in Sheffield, out of 145 inmates there were 4 attacks and 2 deaths ; in Bristol there were 210 inmates and no case. The total number of inmates in all the refuges was 1,691, with 33 attacks and 10 deaths.

In several instances the poor quarters of towns were depopulated by removing all who would consent to removal, to high, open ground, where tents or barracks were prepared for them. The result was that those removed escaped with only diarrhœa, while those who remained, with few exceptions, perished. It was a noticeable fact also that when families were removed to houses of refuge, and had their apartments cleansed, and were themselves bathed and fed, they remained well after their return to their old quarters.

CHOLERA HOSPITALS.

A third measure of relief, hitherto much relied on, is the hospital. In every epidemic of cholera, hospitals have been early established, and great importance has been attached to them. But it is questionable if, in this particular, we are not again treating cholera as an ordinary disease, and losing sight of the fact that it is a pestilence governed by peculiar laws in the progressive development of its several stages. Whoever has had charge of a hospital which received cholera patients must have been struck with the fact, that large numbers of them on admission were in partial or complete collapse, although when they left home, they were reported to be in the earlier stages. A consultation of the records of cholera hospitals in this and other cities, confirms the opinion that many cases pass into the state of collapse while being transferred to a hospital.

Dr. Sutherland says: "I have known a patient taken out of bed with a warm skin and a good pulse, arrive in a state of fatal collapse at the hospital, though not above a quarter of a mile distant." Dr. Adams of Glasgow remarks: "At first, when I had all my experience to gain with regard to the treatment of cholera, I was favorably disposed to the employment of hospitals, and looked with painful apprehension to the treatment available to the sick poor residing in dwellings abounding in negations, *sans* good fire, bedding, clothing, light, air, quiet, attendance, etc. I am now, however, clearly satisfied that a pauper patient lying on his wisp of straw, on the bare floor, with a relation or other attendant to supply him with a drink of cold water, and to surround him with a few hot bricks, has the chance of recovering fearfully diminished by removing him to all the comforts and refined treatment of a hospital. If my experience on the subject were singular, I would hesitate to venture so decided an opinion; but from careful inquiry which I have made among many of the parochial surgeons, I find their experience so entirely corroborative, that I feel no hesitation in condemning the principle of hospital treatment for cholera patients."

Hospital treatment, as compared with home treatment of similar cases, shows largely in favor of the latter. By careful estimation it appears that in Liverpool and Glasgow 53.8 per cent. of the cases admitted to hospital died, while in the home treatment but about thirty-six per cent. died.

The English Board of Health makes the following statement: "From the experience of Great Britain and other countries in 1831–32, we came to the conclusion that the treatment of cholera patients in hospitals was not successful, and we discountenance the use of these establishments, recommending that the best provision practicable should be made for affording assistance to the individuals who might need it at their own homes, particularly by the selection of proper persons instructed as nurses in the special services required on the occasion, and paid for devoting their whole time to attendance on the sick at their own habitations, under the direction of medical officers."

The evidence would seem therefore to be conclusive against hospitals as formerly established for the treatment of cases of cholera. It cannot be denied, however, that cases will occur in large towns where the patients will

be so destitute that they must be removed from their domiciles for treatment. For such persons provision must be made, and the form of a hospital must be maintained. But such hospitals should be very small, and in the immediate neighborhood of the destitute class. It should be borne in mind that in the transportation of cholera patients, distance is a most important element. Of the cholera hospitals in Liverpool in 1849, those situated in the infected district had a mortality of 7.6 per cent. less than those situated at a distance from the people who entered them. At Glasgow the mortality was ten per cent. in favor of the hospitals near the cholera foci. Whatever hospitals are established, therefore, for the treatment of cholera patients, should be located in the immediate vicinity of those for whose benefit they are designed. Any small building, or even apartments, may be taken which give accommodations to ten beds, with apparatus for heating water and cooking.

CONCLUSIONS.

In consideration of the preceding facts, municipal authorities and Boards of Health should adopt as special measures of prevention and relief during the actual presence of epidemic cholera: —

1st. A system of gratuitous administration of medical relief at the houses of the laboring classes, should be so regulated as to reach all cases of premonitory diarrhœa, and united with instruction and advice.

2d. Refuges should be opened at convenient and healthy localities, for the temporary residence and purification of those whose domiciles require cleansing and disinfection, or to be permanently closed.

3d. Hospitals for the reception of patients suffering from cholera should be very small, and located in the immediate vicinity of the cholera focus.

WHAT WE CAN DO AGAINST CHOLERA.

PRACTICAL INSTRUCTIONS CONCERNING WHAT TO DO TO PREVENT AN EPIDEMIC AS WELL AS HOW TO GUARD AGAINST IT DURING ITS PREVALENCE.

By MAX VON PETTENKOFER, M. D.,

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As cholera, on its first appearance in Europe, unmistakably proceeded and spread on the principal lines of human intercourse, at sea as well as on land, it was considered to be a contagious disease. More minute observations, however, soon demonstrated that the spread of cholera in Europe no less than in India — its home, also — *considerably depended upon locality and season.* It was observed not only that, with the same circumstances of intercourse, certain localities and districts were attacked very differently; some very violently, others not at all, but also that the places susceptible to cholera were so only at certain times, and that some were attacked more, others less frequently, while this difference could not be attributed to any different intercourse.

It was therefore concluded that in addition to the specific cholera germ coming from India, and which, no matter in what manner, attaches itself to human intercourse, there must be some agent, not to be found in man himself, but in the geographical site, although not at all times and in all localities, but which may be said to serve as a local nourishment for the specific cholera germ spread by human intercourse.

The spread of cholera depends, therefore not solely on personal intercourse, but intercourse, locality, and season, must act together. The in-

[1] The Health Department (*der Gesundheits-Rath*) of the city of Munich, consisting of six physicians and five other eminent citizens as counsellors, respecting the duties which the people owe to themselves in the presence of an impending visitation of cholera, directed that its special counsellors, consisting of Professor Max Von Pettenkofer, Dr. Ludwig Buhl, Dr. Erhardt, and Dr. J. Widenmayer, should prepare a code of instructions for the people of the city. Accordingly, this epitome of advice and information for popular use was prepared by Professor Von Pettenkofer, and was published early in the season before cholera actually appeared in Munich, in the summer of 1873. But it is the misfortune and culpable fault of nearly all the dwelling-houses in the Bavarian capital that they have their privy conveniences inclosed within the common domicile, like a series of closets appended to a chimney, or an ash-fall from garret to cellar, and to a great extent without means of water-flushing them. Hence, when cholera began to prevail in that city, its infective element had great facilities from this abominable system of cloacal conveniences in the dwellings, as well as from the great number of city and private wells of water. E. HARRIS.

fluence of the latter two factors have been termed *local* and *temporary* disposition.

In every place and house attacked by an epidemic form of cholera, it has also very clearly been observed that the inhabitants, although equally exposed to the influence and action of the specific cause of the disease, have been attacked very differently, some violently, others slightly, others again not at all. This has been called *individual* disposition.

The attacks by cholera, and their frequency, depend principally, therefore, upon the contemporary action of several, more especially of *three factors* (1) the intercourse; (2) local and temporary disposition; and (3) individual disposition. When any one of these three factors is absent — no matter which one — no outbreak of cholera will occur. To guard against cholera we can, therefore, advance in each one of these three directions. The result of our efforts depends partly upon the thoroughness of our knowledge, partly upon the influence which we can exert upon the single factors; but every effort for the prevention of cholera must be based upon one of these factors.

Let us see, therefore, what has been ascertained in each of these three directions, and what can be done.

The advance in the first direction is the most difficult. Free intercourse is such a great blessing that we could not dispense with it even for the price of remaining free from cholera and many other diseases. A prevention of such intercourse to such a degree that cholera could no more be spread by it, would be a far greater calamity than cholera itself, and the nations would fight bloody wars to break down such fetters if they were imposed upon them. Life is not by any means the greatest of blessings to man; there are higher ideal gifts for whose possession he is ready to sacrifice it. A total prevention of intercourse has, therefore, never been employed as a general prevention against cholera, and only a supervision and regulation of the intercourse has been attempted by establishing military cordons on land, and quarantines at sea.

The result of both these measures is, however, always so slight or totally negative, that we could dispense with them — especially the former one. Only the quarantines for ships are yet enforced in different localities, but it is just this measure which is out of the question in the case of Munich.

Although the prevention of intercourse is an impossibility, the greatest possible cleanliness and cleansing of the intercourse from the cholera germ attaching to it, is a practical measure. To employ it with success, however, it would be necessary to know with much more certainty than is the case at present to what objects the cholera germ attaches itself, by which it is spread from one place to another. The single fact that cholera is transportable by human intercourse, has, up to this time, led to the conclusion that it is a contagious disease, which is transmitted from the sick to the healthy, and that the disease during its prevalence in the body of the infected person again produces the germ of infection or contagion for others; but the clear and important dependence of the spread of cholera *not from intercourse alone*, but from *locality and time*, makes the quality of contagion

in cholera seem to be quite doubtful. It is proven by experience that physicians and nurses in cholera hospitals in the average do not suffer more in consequence of their care of the sick than persons that have no intercourse whatever with the sick. It has been frequently observed in large hospitals that received a great number of cholera patients during cholera epidemics, that neither physicians, nurses, or patients under treatment for some other disease, were infected.

In Calcutta, where cholera always prevails, like typhus in our cities, at different times with more or less severity, the general hospital there has not, in thirteen years, become a source of infection for other patients, or for nurses and physicians, although during this period many hundred cholera patients were admitted, and were frequently even treated together with other patients in the same ward. If in a hospital during an epidemic a large number of nurses and patients are attacked by cholera, this fact cannot be considered as a proof of contagion by persons suffering from the disease ; it is only a proof that the hospital, in the same manner as any other house, has become a cholera nest.

The fact that cholera is spread more by infecting localities than by infected persons, is of the greatest practical importance. It is the greatest reason for a fearless care of the sick. No one has reason to shun a person sick with cholera with whom he lives in the same house. If the house has already become a nest of infection, it does not at all prevent the healthy from becoming infected, even if they shun the sick with the greatest care. If the house has not become a nest of infection, and the sick person has become infected at some other place, the patient cannot be considered as a source of infection in this house.

In a few, we may say the exceptional cases, in which cholera seems to appear as a contagious disease, *i. e.*, when a person goes from a cholera locality to a place free from it, there becomes sick and after him several persons in his immediate vicinity that have taken care of him, washed for him, etc., are attacked, these facts may be explained by the supposition that the person seized by the disease brought with him from the infected place, in a manner not yet ascertained, enough of the germ of the infection to produce several infections in other places. Such cases, considered as contagious, have so far occurred most clearly infrequently in localities not susceptible of cholera (as Stuttgart, Wurtzburg, etc.), but nothing speaks more against the theory of contagion alone than just these cases, because no further attacks have occurred from them, and no epidemics have been developed.

It may be considered a fact that by clothing, and especially by filthy, damp clothing, which has been for some length of time in a cholera locality or other nest of infection, a sufficient quantity of the germ of the infection may be brought to a second place previously free from cholera, to infect persons who come into nearest contact with these articles, but not because the clothing comes from a cholera *patient*, but because it comes from a cholera *locality*. If the conditions of local and temporary disposition are present in this second place, this imported germ of the infection not only serves for the infection of a generally very small number of those

that come into nearest contact with him, but it is also the seed for a local epidemic by which this place also becomes a cholera nest, while, if these conditions of local and temporary disposition are not present, the cases will be only scattered or sporadic.

Great care should be taken, therefore, not to send away such articles from cholera houses without being cleaned and disinfected, and care should also be taken how to receive such articles sent from them. They should never be opened in the house, but in the free air, and should be treated in the manner described in the chapter on disinfection.

There are now several instances known that lead us to think that especially damp and slimy food, containing much water that comes from cholera houses or other nests of infection, accumulates and condenses so much of the locally produced germ of the infection, that its use in another house or in another locality without previous cleansing or renewed boiling, can cause the disease. Such observations were made principally in England and Switzerland with boiled calves feet, and in India with rice-cake. What should be done in such cases is shown in the chapter on food, which is discussed in the part on individual disposition.

The influence of intercourse has formerly and up to recent times been regarded as almost exclusively in the excrements of the persons sick with cholera, and especially in the intestinal discharges. Facts, however, from the beginning, proved that the *fresh* excrements of cholera patients contained no power of infection, but only such as were already decomposed, and the latest observations made in India have not strengthened the belief in the localization of the germ of the infection in the excrements, but on the contrary, have materially diminished it. Science at present observes with great attention the manner in which cholera spreads, less from a theoretical standpoint, than to ascertain by indisputable facts the different localization of the germ of infection. This, however, does not justify us in not paying attention to the intestinal discharges during a cholera epidemic. On the contrary, experience has given us many reasons to apprehend fatal results upon local and individual disposition for cholera, from a careless treatment of the excrements.

But we must warn against depending on the disinfection of the excrements alone, and *must do much more* than has been done heretofore in paying attention to the cholera-producing localities, and every thing connected with them. According to the facts observed, it is not only possibly, but even not improbable that the excrements of cholera patients have perhaps no connection with the spread of cholera, and that, for instance, a house becomes a cholera house, not because it has a privy in which the excrements of a person sick with cholera have been deposited, but from a different, up to this time unobserved mode of causation. This will make it necessary, in order to disinfect successfully, not to give attention to water-closets and privies only, but to observe also other parts of the house and articles in it, which hitherto, in consequence of a blind faith in contagion, have escaped observation.

Since cholera has been observed in its spread over larger parts of country,

there has been demonstrated besides the influence of the intercourse, the influence of locality and season, upon the epidemic appearance of cholera with great clearness, in fact often more clearly by the two latter conditions than by the former one, so that many have been led to totally overlook or deny the influence of the intercourse from place to place. There even was a time, soon after the first appearance of cholera in Europe, where it remained from 1831 to 1837, when the large majority of physicians denied that cholera was carried from place to place, because it was thought that by the concession of the possibility of *transmission* of the disease its *contagious* character was also admitted. After cholera, which advanced along the commercial routes of Asia through Russia, had, by reason of its manifest transmission, been principally considered as a contagious disease, there followed a great reaction in the opposite direction. This reaction necessarily followed after all the very expensive measures, like military cordons and quarantines, which the theory of contagion had called into life, were shown to be useless. Only after the re-appearance of cholera in Europe in 1848, the belief in the influence of the intercourse again gained ground, soon, however, to fall again into the former extreme in regard to contagion, and the important influence of locality and season was for a time left unobserved.

That the spread of cholera does not depend upon intercourse *alone*, but also upon local conditions, is shown in every country as soon as it is visited by a cholera epidemic. If we examine a map upon which are shown the fatal cases of cholera, and especially the localities of cholera epidemics, we will always and everywhere find that the epidemically attacked localities are not grouped around the principal routes of intercourse, but according to geographical site; that, for instance, the cholera epidemics are very unequally distributed on the railroad lines, so that it is very clearly demonstrated that *intercourse solely is not the only condition*. In every country the local cholera epidemics are grouped more along river and draining lines, than along the principal routes of intercourse.

There are localities which are highly and frequently, often in periods of a few years, susceptible to cholera, while again there are places which have, in part, always opposed the invasion of cholera, and partly have been susceptible to the disease only in long intervals of time.

This is not the place to discuss the causes of the local and temporary disposition more at length; the medical profession itself has as yet lively and often contradictory debates in regard to them; but with the observations and examinations that have been made in Europe and India, there can be no doubt that this factor exists, that it is an important one, and that it has its principal causes in the geographical locality, and in atmospheric and climatic influences upon the soil.

In regard to season, summer and autumn are the principal periods for cholera. It sometimes happens that the epidemics in some places begin earlier and end later, but it is seldom that the average course of an epidemic transportable disease shows such a strict dependence upon season as cholera in our latitudes and in our climate.

Nothing demonstrates this so clearly as a table showing the total number of attacks and fatal cases of cholera that have occurred in the kingdom of Prussia in all epidemics from 1848 to 1860.

During this time there were:—

	Attacked.	Persons Died.		Attacked.	Persons Died.
April 1–15	71	50	October 1–15	35,874	19,462
16–30	110	62	16–31	29,903	15,809
May 1–15	192	112	Nov. 1–15	21,215	11,363
16–31	650	334	16–30	11,621	6,267
June 1–15	3,819	1,961	Dec. 1–15	8,100	4,246
16–30	4,894	2,431	16–31	5,665	3,008
July 1–15	6,106	3,050	January 1–15	2,857	1,424
16–31	10,866	5,430	16–31	1,719	893
August 1–15	21,870	11,674	Feb. 1–15	909	510
16–31	41,758	21,966	16–28	687	332
Sept. 1–15	57,395	31,048	March 1–15	266	159
16–30	45,415	25,513	16–31	74	55

These figures show one unmistakable influence of the season that cannot be explained by the influence of the intercourse. The temporary influence which is thus so clearly shown is probably connected with the climatic and meteorological circumstances, which act differently upon different geographical localities, different soil, etc. It would be a mistake to take under consideration the atmospheric influences only during an epidemic; they should be noted without interruption, especially everything preceding the epidemic for a longer period of time. If, without considering any theory, it is asked what the characteristic meteorological features were in Munich during its two cholera epidemics, they both occurred during exceedingly dry seasons, especially the summer of both years being very dry.

As in Munich typhus abdominalis depends, to a certain extent, on the fluctuations of the dampness of the soil, of the so-called soil-water, such a dependence is also probable in the case of cholera, but with the fortunately rare occurrence of cholera epidemics in Munich it has not yet been so conclusively proven as in the case of typhus, in regard to which soil-water observations have been made for more than sixteen years.

In regard to the soil-water and its influence upon diseases, there are not unfrequently very mistaken ideas. Many people consider the soil-water in itself to be a danger for them, and believe that if they can bring it further away from them, or if they do not drink any, they have removed the danger. The fluctuations of the surface of the soil-water in the porous soil of

Munich, are only of importance in so far as by them the course of certain organic actions in the soil is diminished or increased, while the soil-water in itself may be something quite inoffensive and innocent. It is only the most accurate means of measuring the change of the soil-water which is at our command.

[Professor P. describes, at some length, the soil of Munich: Upper stratum, a calcareous drift, very porous, of an alternating depth of from twenty to forty feet, resting upon a stratum of marl, the depth of which is as yet unascertained, but which, according to late borings, undoubtedly has a thickness of many hundred feet. — E. H.]

In view of the great porosity of the soil of Munich, it is more necessary there than in many other localities that all receptacles for excrement should be kept as air-tight and water-tight as possible; that all privy vaults should be removed, or should only be permitted for the reception of clear water, like rain-water, but not for water impregnated with foul organic matter, which should either be kept in water-tight receptacles before removal, or should be removed in well constructed and flushed canals.

This explains the fact which has been clearly demonstrated in a large number of English cities, that the removal of all privy vaults, and the introduction of good sewerage always diminishes the mortality of the place, sometimes very considerably so. In Munich, since the introduction of air-tight privy sinks and canals (sewers?), a certain decrease in the mortality, especially of typhus abdominalis, can be proven. From 1855 to 1859 there died on the average two and one half per one thousand inhabitants of Munich of typhus, while the mortality by that disease from 1859 to 1868 was only one and one half per one thousand. This shows that the mortality by typhus has fully decreased one third, and although this may be partly explained by the better medical treatment of typhus now as compared with former times, the decrease of the number of attacks by that disease deserves consideration.

Although it would be a mistake to suppose that every locality susceptible to typhus must in like degree be susceptible to cholera, experience has nevertheless frequently shown that cholera has a special preference for such parts of localities as are visited epidemically by enteric typhus. The more filthy and the more impregnated a stratum of soil is, the more active an agent it is for cholera and typhus.

When cholera visited Bavaria and Munich in 1854, the Cholera Commission at that time called special attention to some facts which deserve to receive consideration now. Those houses or localities in Mulden which were situated in the lowest parts of that place or immediately at the foot of precipices, showed, in the large majority of cases, a far greater disposition for cholera than houses and localities situated on the elevation between two hollows, or that were farther away from precipices. As the disadvantage of such a site is principally to be found in faulty drainage, and much dampness and unclean condition of the soil in consequence thereof, the drainage and cleansing of the soil of houses so situated should receive an even greater degree of care than others more favorably situated.

In localities that have already been frequently visited by cholera, experience gives to us valuable points for the observation of a higher or lower degree of susceptibility of different parts of such localities that are of great usefulness. It is known that certain groups of houses, on being attacked, suffer severely, and much more than others compared with them. The speedy evacuation of such cholera nests has frequently proved to be accompanied with good results, and it is the principal measure in India, where it has been employed, especially in troops stationed there, with some visible success.

If we wish to evacuate or remove, however, it is also necessary to know where to deposit, so that we will not come, as the saying is, "Out of the frying pan into the fire." We should find localities that are as unsusceptible to cholera as we can find them — so-called "immune" localities. To find these the best and most certain thing is to be guided either by the experience of other places, or by that of the infected locality itself, if there had already occurred cholera epidemics in it.

Different localities of Munich have shown themselves to be susceptible to cholera in very different degrees at its two epidemics. Munich is fortunate enough to have in its immediate vicinity an unsusceptible district upon the right bank of the Isar, the clay soil reaching from Ramersdorf to Ismaning, upon which stand the numerous brickyards that supply Munich with brick. That a clay soil which overlies calcareous drift, in which the soil-water never rises high enough to reach the clay, is unsusceptible or "immune," is a fact that has also been frequently observed in other places as well as in Munich in its epidemics of 1836 and 1854, where the epidemic spread of cholera was confined to the houses standing upon gravel, while those upon clay escaped in a remarkable manner.

As experience has shown that in all epidemics the disease in single houses exhausts itself within a period of fourteen days on the average, the houses evacuated might be re-inhabited after that period of time, after having been thoroughly cleansed and disinfected.

Whoever considers with attention what has here been said in regard to *local and temporary disposition*, must see that everything that can be done must be accomplished previous to the outbreak of an epidemic, or must at least be prepared. All measures, for instance, for the cleansing of the soil, or its better drainage, would be accompanied with no results if only begun at the time of the outbreak of an epidemic; for a long time, and care, is necessary to purify an unclean, impregnated soil.

Experience has conclusively proved that different persons are very differently affected by the germ of the cholera infection; that some are attacked violently, others slightly, and the majority not at all. At the epidemic in autumn, 1836, two per cent. of the population of Munich were attacked by cholera, and in that of the summer of 1854 something more than five per cent., about half of the cases in each instance terminating fatally. There were also observed a much larger number of diarrhœa and other slight diseases, whose appearance must be attributed to the same causes as those that produced cholera. When a large house that is attacked

by cholera is inhabited by one hundred persons, each one of them is exposed to the causes of the disease; but if only five of them are attacked by it, there must be some reason why it should be so, as well as why the other ninety-five escape. It should be the endeavor of each single one to be, if possible, one of the ninety-five, and not one of the five out of the hundred. The factor which is necessary in addition to the specific cholera germ which is spread by intercourse, and the local and temporary disposition which is developed by localities, to cause cholera in single individuals, is called *individual* disposition. Though it is not as yet possible to scientifically define and explain this individual disposition with accuracy, there are still some things known to cause it with certainty.

The transudation of large amounts of water from all organs through the mucous membrane of the stomach and the intestines is one of the principal symptoms of cholera. It is proven by experience that every attack by cholera is almost invariably preceded by more or less severe diarrhœa — so-called choleraic diarrhœa — for a longer or shorter period of time until it changes to cholera. It is true that at the time of an epidemic there occur a great number of cases of such choleraic diarrhœa that are not succeeded by cholera, and exhaust themselves without any evil consequences, even without medical treatment; but it is proven by experience that such diarrhœas, if persons that are afflicted by them immediately go to bed and call for medical attendance, are hardly ever succeeded by cholera, while most cholera cases are preceded by neglected diarrhœa. This is matter of experience, not depending on any theory.

At the outbreak of a cholera epidemic the sanitary authorities can, therefore, do nothing better than to carefully search out all cases of diarrhœa and bring them under medical treatment. The Bavarian government deserves credit for its action in 1836, which has since been imitated at many places, when, soon after the outbreak of cholera, *it caused the whole city to be divided into districts and organized medical visitation stations, whose principal duty was the timely discovery of the harbingers of the disease by daily visits of the physicians in the houses of the healthy of their district, and immediate medical care.* Should Munich be unfortunate enough again to be visited by cholera, it is expected of the intelligent of the population of the city that such measures will be received with the necessary cheerfulness and confidence.

In several localities that have lately been visited by cholera, there have been organized special institutions for the reception of these harbingers of cholera, so-called diarrhœa stations, which have proved a successful asylum, provided the selection of the locality has been a fortunate one.

As diarrhœa has so important a connection with cholera epidemics, we should ascertain what are its principal causes. The most common and general causes are certainly colds and faulty diet. The former cause consists in interruptions of the degree of heat, in the economy of the body's heat, which supplies the skin, and almost alone regulates it; the latter cause in interruptions of the digestion, etc., etc. [Professor Pettenkofer describes faulty diet. — E. H.]

The wearing apparel which most people principally consider from the standpoint of morality and beauty, or ornament, is of such important physiological and hygienic uses, that in this respect it ranks among the greatest and most indispensable of the discoveries of man. The wearing apparel causes, upon the whole covered surface of the body, an even temperature of much mildness, on the average 30° C. or 25° R. The always even degree of the heat of the blood and the inner organs of our body ($37\frac{1}{2}$° C. or 30° R.), is a hygienic law that cannot be violated with impunity.

With the great change of the temperature of the air, man, even when clothed, could only insufficiently comply with this law, if nature had not supplied him with a very fine regulating apparatus in the nerves of the skin, which labors incessantly by more and more closing, with the increase of cold weather, the gates that discharge the heat through the surface of the skin, and in the same manner opens them with the increase of heat. It is literally true that the skin, on becoming cold, prevents a too rapid loss of the heat of the interior of the body; and also, that on becoming warm, it cools the interior of the body. This regulating apparatus must, however, be kept in order, and not be imposed upon too much.

Every kind of labor requires practice (exercise). The apparatus or regulator in the skin of any person, therefore, who would live always under the same conditions of production and loss of heat, would become enfeebled. A certain daily change of the conditions, therefore, is necessary for health. A person that labors hard within a room, produces more heat and wears light clothing during the performance of his work, but feels also the want to breathe, more thickly clad, the fresh air, by which he experiences an agreeable coolness. A person that is forced to labor hard in the air during the day, prefers to sit near the stove for some time. The body seems to require this change, so as not to be forced to labor incessantly in one direction. But, as already said, these changes should never be too violent or too sudden.

[Professor P., at some length, recommends cleanliness, frequent bathing of the body, the public provision for a larger number of baths, etc. — E. H.]

During cholera epidemics it is especially to be recommended to keep the stomach and the feet warm, for which purpose flannel bandages and woolen stockings should be used.

Good beds, clean under-clothes, and good wearing apparel, are the most important measures against interruptions of the transpiration. The activity of the skin may be aided by internal agents (peppermint, camomile tea, warm wine, etc.), according to the judgment of the attending physician in different cases; also by the use of steam baths.

. . . .

We must eat, even when cholera is present. It is an almost universal experience that badly fed persons are even far more susceptible to cholera than those that are well fed. As the transudation of serous fluids through the organs into the intestinal canal is the most important feature of the cholera process, everything that can prepare, favor, or cause such a watery

flux, is of the greatest importance. It is favored by everything that tends to excessively irritate or weaken the intestine, and by everything else that tends to either increase the normal water supply of the organs, or to decrease the normal discharge of the water of the body. To cause a condition of the body best calculated to oppose the influence of the causes of cholera, the quantity of food used, though moderate, should be sufficient; it should also be of good quality, and easily digestible.

In conclusion, it is the opinion of the Board of Health that every person, when cholera is present, should eat and drink whatever has been to his taste before, and has not been attended with evil consequences; always, however, guarding against excesses of any kind. Special care should be taken against everything that has proved to be injurious at other times. Whoever is accustomed to pay attention to the condition of his body, knows much better himself than anybody else can tell him, what kind of food has in former times been accompanied by evil consequences, such as diarrhœa, etc.

It being at all times a matter of importance not to consume stale, decomposed food, etc., it is a matter of course that, at such a dangerous time as during a cholera epidemic, it is far more important still. The authorities are therefore justified in increasing the degree of care taken (by the "food police") in the supervision of the food, and each single individual should try to act in the same direction.

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In Munich, the influence of the drinking water upon the cholera epidemic of 1854 has been submitted to a very thorough examination, and it has been conclusively shown that there was not the slightest proof that it had any influence whatever upon the spread of the disease. It has also never been experienced that the drinking water of Munich was differently constituted before, during, and after a cholera or typhus epidemic than before; and the inhabitants of Munich can, therefore, in future, even with the presence of a cholera epidemic, use the water of the public waterworks without apprehensions of inviting cholera or typhus thereby.

[The importance of cleanliness of water, soil, and air, is graphically set forth by Professor Pettenkofer. — E. H.]

Domestic cleanliness and comfort is of the greatest practical importance and value. What is called domestic comfort in its widest sense, though not containing any specific measures or medicines against special diseases, is yet undoubtedly of the greatest value for health. During the last two centuries the specific diseases in England have not become less, but rather more; certainly cholera has been added to them. According to observations based upon the statistics of the mortality of London, the mortality, with the enlargement of the city and the increase of its population, — or rather, in spite of the enlargement of the city, and in spite of the increase of the population, — has steadily decreased.

From 1681 to 1690, the mortality of London, with a population of 530,000, was equal to the rate of 42 per 1,000, annually.

From 1746 to 1755, out of 653,000, it was 35 per 1,000.

From 1846 to 1855, out of 2,362,236, it was 25 per 1,000.

At present London has a population of about 3,000,000, and a mortality of 22 per 1,000. Munich, with but 177,000 inhabitants, during the last ten years had a mortality of about 33 per 1,000, so that it was not as small as that of London from 1846 to 1855, during which time England was visited by two severe cholera epidemics. These facts should teach us that we yet need many improvements. In regard to salubrity, we should not take Berlin, where the mortality is considerably higher even than in Munich, as a sample, but London, where it is one third less. We should not only be supplied with pure and wholesome food and good drinking material only, but also with pure, fresh air; and this is but too frequently wanting. It is, therefore, of the greatest importance that all habitations should be constantly supplied with pure, fresh air; and the utmost care should be taken in keeping them thoroughly ventilated. The air not only constantly surrounds us, but we also constantly use it by breathing it. The amount of air which a grown person, with an average of sixteen respirations per minute, consumes in his lungs in twenty-four hours, is much larger than most people are aware of, being an average of 9,000 litres, or about 360 cubic feet daily. Of drinking material and food together we consume, during the same period of time, a maximum of hardly four litres.

The idea might, however, be entertained that with the light weight of air, it would not amount to more than the four litres of food and drinking material. This would, however, be totally erroneous, for air is but 770 times lighter than water; and these 9,000 *litres* of air which we consume in twenty-four hours, have a weight of twenty-three pounds, while the total amount of food does not weigh one third of that amount.

The air out of doors is at all times of a very equal composition, and is generally pure air. The air in-doors constantly changes to a certain degree, even against our will, and without our own agency. No house has its own air only, but that of its surroundings. The air that comes from without and stagnates in the house for a longer or shorter period of time becomes polluted by different agencies. These pollutions are partly unavoidable, partly avoidable ones. To the most unavoidable ones belongs the pollution of the air by the activity of the skin and the lungs, for not to pollute the air in this manner would be to cease to live. The avoidable causes consist in everything that, in the form of gas or dust arising from insufficient cleanliness or careless treatment of garbage, etc., intermixes with the air.

Whoever desires to guard against any future epidemic, be it cholera or typhus, should now begin to observe the greatest cleanliness in every corner of his house, and regularly ventilate every room. The more overcrowded and the smaller a habitation or a room is, the more necessary is the utmost cleanliness and sufficient change of air.

Though there are as yet no instruments for the determination of the quality of the air of rooms that could be handled by laymen as easily as the thermometer for ascertaining the degree of their heat, bad air makes such an unmistakable physiological impression upon our smelling organs — our olfactory sense — that we can use it to determine, with tolerable accuracy, the quality of the air.

For a long time it has been a custom to place chloride of lime in rooms, without, however, proof of its actual efficiency. Though it changes and destroys most organic substances, it is necessary for the complete destruction of all organic substances of the air that a much larger amount of chlorine should be transmitted into the air than we can gain by employing chloride of lime.

An air that would contain enough of chlorine to prevent the existence of all organic substances could not be breathed, for we must not forget that our own body is an organic substance that is no less attacked by chlorine than organisms antagonistic to us. To consume disinfecting agents with the air is as impractical as it would be to mix it with any other food for our consumption.

There are certain parts of the house from which principally emanate a pollution of the air, and which, therefore, should receive special attention. These are the privies, sinks, and the receptables for garbage, etc., and for the reception of soiled under-clothing.

In regard to the privies, there were given directions after the cholera epidemic of the year 1854, not alone in regard to the privies themselves, but also in regard to the removal of their contents. The ideal of a privy is such a one as will prevent any pollution of the air or the underlying soil of the house with emanations from the excrement. This ideal can be attained in several ways, but it is certainly not saying too much that those of Munich are as yet very far removed from it.

As excellent and certain measures to prevent any air from emanating from the privy-pipe into the house, we can recommend the following two: (1) water-trapping (water-closing) with flushing-apparatus; or (2) complete and constant ventilation of the privy-pipes by which the air passes through the pipes outside of the house and passes out when above the roof. The former arrangement which is in almost general use in England, and which is called water-closet, necessitates a supply of water on every floor of the house, and the possibility to immediately remove the contents of the water-closet by canals (sewers).

The second arrangement — the ventilation of privies with air and water-tight vaults, can be used if desirable, but it necessitates the expense for a constant supply of heat to give the air the direction required. The Board of Health cannot go here into technicality (details), but can only give a general illustration of these arrangements. The arrangement of water-closets is, moreover, known and in use in several houses of Munich, and the ventilation of privy-pipes is in successful operation in several public buildings.

It might be thought that ventilation of the privy-pipes did little, if anything towards improving the purity of the air of a house, as the stench though not immediately pervading the house, would be transmitted into the air surrounding it, and must again enter the house. This fear would be unfounded. The motion of the outside air has an average velocity of ten feet in one second, and is so rapid that such emanations or evaporations are immediately diluted to such a degree as to become inoffensive and harm-

less. Most of the privies of Munich are so constructed as to pollute the air of the house to a greater or less degree. It is a question of public hygiene which is at present extensively discussed, how to remove in the most practical and cheapest manner all excrement, garbage, etc., of human habitations without polluting the air, the soil, or the water of the house. The city of Munich, like all other larger cities, must make earnest efforts to institute better arrangements than those heretofore in use, but, under existing circumstances, it is proper to consider what measures to take in the presence of an epidemic, to counteract the evils of existing circumstances. In addition to the utmost cleanliness in privies there are two means by which we can considerably lessen the degree of pollution of the air of the house, viz. (1) good ventilation of the privy; (2) disinfection of the excrements.

In regard to the former measure, action can be taken everywhere, for it is law in Munich that every privy shall have a window connecting with the air.

As the decomposition of the excrements which takes place soon after their discharge is one of the principal causes of the pollution of the air, everything which prevents this decomposition is of the greatest importance. The means employed for this purpose are called disinfectants, and the Board of Health will enumerate, in the chapter on disinfection, all the means most suitable for the disinfection of excrements, privies, and privy-vaults.

The sinks in which the swill and the water of the kitchen generally is emptied, are also frequently means of polluting the air. They are usually situated in the kitchen, and are generally connected with open or badly closed vaults or canals in which these materials decompose. As long as there is a fire in the kitchen, even as long as the kitchen-stove is only little warmer than the outer air, which is the case almost throughout the year, the air of these sinks, according to unchangeable physical laws, will come into the kitchen, and will bring with it and transmit into the air all the foul effluvia with which it becomes charged on its most unclean way. These evils can only be prevented by water-traps.

All scraps, garbage, or rubbish of the house which is placed into dirt barrels, should also be removed as quickly as possible.

Thorough cleanliness of the whole house and of the body of every member of the family, as well as conscientious preparation of good healthy food for the family, is of the greatest importance, and no one can do more in this direction than the housekeeper, by constant and indefatigable attention to these wants. This vocation of the housekeeper is always an important and elevated one, whether an epidemic is present or not; for nothing is more beneficial to the health of a family. . . . .

For the enjoyment of good health there is necessary not only the use of good air, pure water, good food, clothing, and habitations, but also occupation, bodily and mental exercise. There must, however, be no excess of it, and periods of rest are necessary. Excessive labors of any kind predispose as much to cholera as excesses of any other kind, like those in eating, drinking, etc. A person whose daily occupation confines him to his room principally, should have some exercise daily in the air.

Persons who have the care of the sick of cholera should especially be careful to put their bodies in such a condition as to make them antagonistic to the susceptibility to cholera. The utmost cleanliness, good comfortable clothing and bedding, a sufficient quantity of good food and sleep, and fresh air at times, are urgently recommended.

Disinfection. — At the time when the germ of cholera infection was principally looked for in the excrements of the patients, the attention was almost exclusively concentrated upon the disinfection of the vessels and receptacles in which they were deposited, and upon everything that had been soiled by excrements. The history of the disinfection is intimately connected with the development of the knowledge and views in regard to the nature and the manner of the spread of the cholera, as, in fact, nearly all our sanitary measures are based upon temporary theories. It is therefore of the greatest practical importance to develop and correct these theories as the choice of practical measures are based upon them.

At the beginning of the first appearance of cholera in Europe, there were made some experiments in disinfecting, especially with fumigations, but during the epidemics of 1833 to 1837 hardly any disinfectants were used. This was also true of the epidemics from 1848 to 1854, and only from 1854 to 1859, a short time before the cholera left Europe again, these experiments became more frequent. At the re-appearance of cholera from 1865 to 1867, the disinfection of the excrements especially was experimented upon. If we ask whether experience has shown that disinfection has been useful, and whether the course of cholera in places which had epidemics during a time when no disinfectants were used, and at a future time when they were employed, was a different, and such a one as to illustrate the indisputable usefulness of disinfection, we are sorry to say that as yet the question remains an open one. In the year 1836, when, in Munich, cholera was considered to be non-contagious, and even non-communicable by intercourse, the city lost only one per cent. of its population, while in the year 1854, when the contagious character of the disease by the agency of the excrements was accepted by many, and its liability to be transmitted by intercourse was generally admitted, and when sanitary measures were undoubtedly taken in accordance with these views, Munich lost two and one half per cent. of its population by cholera. The epidemics of the year 1866 in many cities of northern Germany, as Erfurt, Leipzig, Stettin, etc., were among the most violent that had ever visited these cities, although disinfectants had never before, or at least, not by far in such quantities, been employed than just in that year.

Should we, therefore, cease the disinfection of excrements? Certainly not, for disinfection may have been employed unsuccessfully up to this time, either because the germ of the cholera is not exclusively, or even not at all, to be found in the excrements, or because the proper disinfectants have not been used, or because they have not been employed in proper quantities or in a proper manner. It is an important duty of public hygiene to ascertain the solution of this question with more certainty than we have had heretofore; experiments in regard to it should be immediately made,

and they are of vital importance, as without them we cannot solve the present state of uncertainty, and can obtain neither positive nor negative results.

Whatever we may think in regard to the efficacy of the disinfection of excrements, its value as an important means of cleanliness can never be questioned, and no one can deny that there are many places and opportunities in which it is exceedingly practicable. We need only call to mind many of our railroad stations, hotels, and other largely patronized places of rendezvous, where anybody who is accustomed to the enjoyment of fresh air must be really afraid to expose himself to the atmosphere there existing. When, therefore, the state authorities not only recommend, but enforce disinfection in certain cases, they certainly are justified in doing so.

The disinfection of the excrements, privies, and other receptacles for excrements, etc., is important also, in another direction, totally independent of the question whether or not the excrements are the carriers of a specific poison. The excrements, as generally dealt with, are, in most instances, polluters of the atmosphere of the house, and it is a matter of experience, independent of any theory, that we enjoy the better health the purer the air is. All uncleanliness is an obstacle against which we must struggle if we would remain healthy. As the purity of the air in ordinary times is favorable to our health and the immunity of our body, it is true to a much greater degree during the prevalence of an epidemic, and pure air is the more necessary at such a time. The excrements most pollute the air when they have the opportunity to decompose and to produce alkaline or ammoniacal fermentation. We need only remember how slightly fresh urine smells and what stench is developed when it begins to decompose. It is also matter of experience that a mixture of urine and intestinal discharges which, in fresh condition, is sour, or which, as the chemists say, reacts sour, does not nearly produce its ordinary stench, even when kept for a longer time, if the original acid reaction is kept in that condition by disinfectants, or in which the acid reaction, if decomposition has already set in, is reproduced.

The purpose of arresting the decomposition of the excrements, or at least to prevent the transit of the products of the decomposition into the air, can be accomplished by different methods, not only by acid-reacting agents, like sulphate of iron, but also by materials of a totally different nature, of alkaline reaction, — quicklime for instance. The alkaline disinfectants have, however, when used for old contents of privy-vaults (like the use of free mineral acids), though useful in other respects, several disadvantages, so that they cannot be recommended for general use. For disinfection generally, only such means are practical whose use, even in excrements already decomposed, does not develop any perceptible substances in the form of gas, and which, also, can be everywhere and easily obtained. For this purpose sulphate of iron with an addition of some carbolic acid, has been found to be most practicable.

In regard to the question what amounts of disinfectants should be employed, it may be said, in general, that the disinfection may be considered

as effectual when the reaction of excrements, and whatever is mixed with them, has ceased to be alkaline and has become perceptibly acid, and this sour reaction of the excrements must remain until they are removed from the neighborhood of human habitations.

It may be taken for granted that twenty-five grammes (nine and one half drachms) mixed with ten times that amount of water, daily, is sufficient for the excrements of one person. This, however, is true only on the condition that the fresh excrements are not mixed with old contents of privy vaults, but that these are either removed before the disinfection, or that they have been treated with sulphate of iron until they have lost the alkaline reaction, and it has become a sour one. The excrements may be kept in an acid condition with sulphate of iron alone, but it is useful to add some carbolic acid, which does not need to be pure for this purpose. If we add two grammes (forty-six grains) carbolic acid to the solution of sulphate of iron necessary for the daily excrements of one person, we can save one third of the amount of sulphate of iron that would be necessary without it. The addition of carbolic acid is, therefore, a matter of economy. The amounts of sulphate of iron and carbolic acid here stated should only be considered as the average amounts necessary. As it is the intention to make the excrements sour, and to keep them in that condition, and this condition can easily be ascertained by litmus paper. To do this it is sufficient to place a drop of the liquid which contains excrements upon a piece of blue litmus paper, and observe whether its color is changed to red. To ascertain the alkaline reaction a drop should be placed upon yellow curcuma paper, whose color is changed to a reddish brown. The presence of carbolic acid can be determined by its smell. If it is desired to examine the air in privies, privy pipes, or canals, in regard to the presence of not disinfected, decomposed excrements, a strip of curcuma paper should be dampened with distilled water, and half of its length placed between two glass plates; the uncovered part should be exposed for some minutes to the influence of the air. All decomposing excrements give off ammonia, and the smallest amount of this element in the air is sufficient to produce a perceptible difference between the covered and the uncovered parts of the damp curcuma paper. All kinds of receptacles for excrements should be treated like privies and their contents.

Soil or privy-pipes of large diameter, sewers that are buried beneath the surface of the soil and are reached with difficulty, etc., can often only with great difficulty, or not at all, be freed from bad odor and ammonia by disinfecting fluids, because the fluid cannot be brought to all parts of them. Such things are best disinfected by burning a sufficient quantity of sulphur in them. The sulphurous acid developed thereby is in the form of gas, and can pervade everything. Sulphurous acid is, in fact, one of the best disinfectants we have.

In place of sulphate of iron, chloride of manganese, a residuary product by the manufacture of chloride of lime, may also be employed, provided the free muriatic acid which it generally contains is previously treated with iron, or neutralized in some other manner. The zinc salts which can be

dissolved in water (like chloride of zinc) may also serve the same purpose, and although they are expensive, have the agreeable quality that they do not, like sulphate of iron, cause the rust spots which are unavoidable with the use of the sulphate.

As, in the event of an epidemic, disinfection of the privies will undoubtedly be again introduced, it would be practical to employ instructed disinfectors whose labors and activity should be superintended by the police. If it is intended to disinfect the air of a house as a means of greater cleanliness, it should be done as completely as possible; it costs but little more than an incomplete disinfection, while this is a totally useless expenditure of money.

Special care in regard to cleanliness and disinfection should be given to everything coming from cholera houses and cholera localities, to which might adhere the germ of infection which is multiplied in the house. That a short residence in cholera localities is not sufficient to cause infection is clearly seen in the number of attacks of physicians. Nobody comes in contact with cholera patients and cholera localities as much and as frequently as physicians, and yet they do not become infected in different proportion than persons of other occupations who have nothing whatever to do with it.

The physicians, also, give the most conclusive proof that the transient visits of cholera patients and cholera localities, in which nothing can be borne away except what is suspended in the air, does not add anything to the spread of cholera, for there is no authentic case in which the physicians, by their visits in families, ever contributed to the spread of cholera in any place. Even if cholera were a contagious disease, which it is not, the general theories in regard to contagions and their spread could not be connected with it.

Cholera patients, a majority of whom are generally sick in *cholera producing* localities, in nests of infection, should only be visited in case of extreme necessity; but if such necessity exists, there need be no special fear if only the same precautions are taken which the physician observes, who, in such houses, does not consume anything but the air he breathes, and who carries nothing home. The air which in cholera localities unavoidably adheres to a person and pervades his clothing, is immediately removed by the air without.

Experience in regard to the transportation of the germ of infection from cholera localities to some other place in such quantity as to cause infections there, shows that, taking all these cases into consideration, these transportations occur but seldom, that therefore special circumstances must favor them. Authentic cases of this kind have, up to this time, only been shown in unclean clothing, soiled under-clothing especially — so called cholera-clothing — and in damp, slimy food. Such articles seem to be capable of taking within themselves and keeping active so much of the germ of the infection from cholera localities, that it serves in other places not only as the means of further development and multiplication, but also as a sufficient focus for other attacks.

Such articles from cholera localities should, therefore, receive special care; they should not be taken and carried away, or if this is imperatively necessary, only with the observance of certain precautions. These consist in complete cleansing and drying, or disinfection. The former measure does not need any further explanation, and disinfection can be made as follows: Pieces of linen and cotton are best disinfected by placing them in hot lye in which quicklime has been dissolved. Woolen articles, cloth, and the contents of hair mattresses and feather beds, should be boiled in water, or fumigated with sulphur. For meat, milk, and other especially slimy food, as also for fruits and vegetables which may possibly have come from a cholera locality, the washing with clean water and a thorough boiling before consumption are recommended during the prevalence of an epidemic. The more the conviction gains ground that the cholera is spread more by infected places and localities than by persons infected thereby, the more will the efforts of disinfection be transferred from the patients and their excrements to the localities in which they were attacked by the disease. An infected locality cannot be thoroughly disinfected as long as it is inhabited by persons, for wherever we desire to produce conditions that will destroy any organic poison present, it is difficult for man to live. Localities which we desire to disinfect must be evacuated. It is a fact, independent of any theory, and which has been observed in every cholera epidemic, at all times, and in every place, that the disease generally exhausts itself in a single house within twelve to fourteen days; there are exceptions, but they are exceedingly few compared with the rule. This rule may be followed if it is intended to leave infected localities, and then to reinhabit them again. As the best disinfectant for closed rooms, fumigation with sulphur can be recommended. It should be done with as closely shut doors and windows as possible. This should be succeeded by a most thorough ventilation and cleansing, and not only the disinfectant should be removed with air and water, but also all filth and dirt of the house. The disinfection and cleansing of evacuated houses would best be intrusted to specially instructed disinfectors who should be under the superintendence of the police.

This brochure is not intended to present an exhaustive schedule of cholera regulations which would enable every individual to battle single-handed against the pestilence on its appearance; it is only intended to call attention to certain important points which should receive the consideration of each individual and the whole community; it is also intended to bring about, on the basis of the experience heretofore, the harmony and the understanding of different opinions which are necessary for a successful coöperation of the public and the authorities. This work should, therefore, not be considered as giving orders, but as presenting advice; it is intended to make easier and extend the understanding of those directions which have already been given, and which will be given in the event of the appearance of an epidemic, and also especially to urge the inhabitants of Munich to prepare everything that should be done previous to the appearance of an epidemic, if they desire to enjoy advantages during its prevalence.

THE ORIGIN AND SPREAD OF ASIATIC OR BENGAL CHOLERA.

By JOHN C. PETERS, M. D.,

Of New York.

Hindostan, especially the Presidency of Bengal, or more particularly the valley and delta of the Ganges, may justly be regarded as the home or place of origin of epidemic cholera.

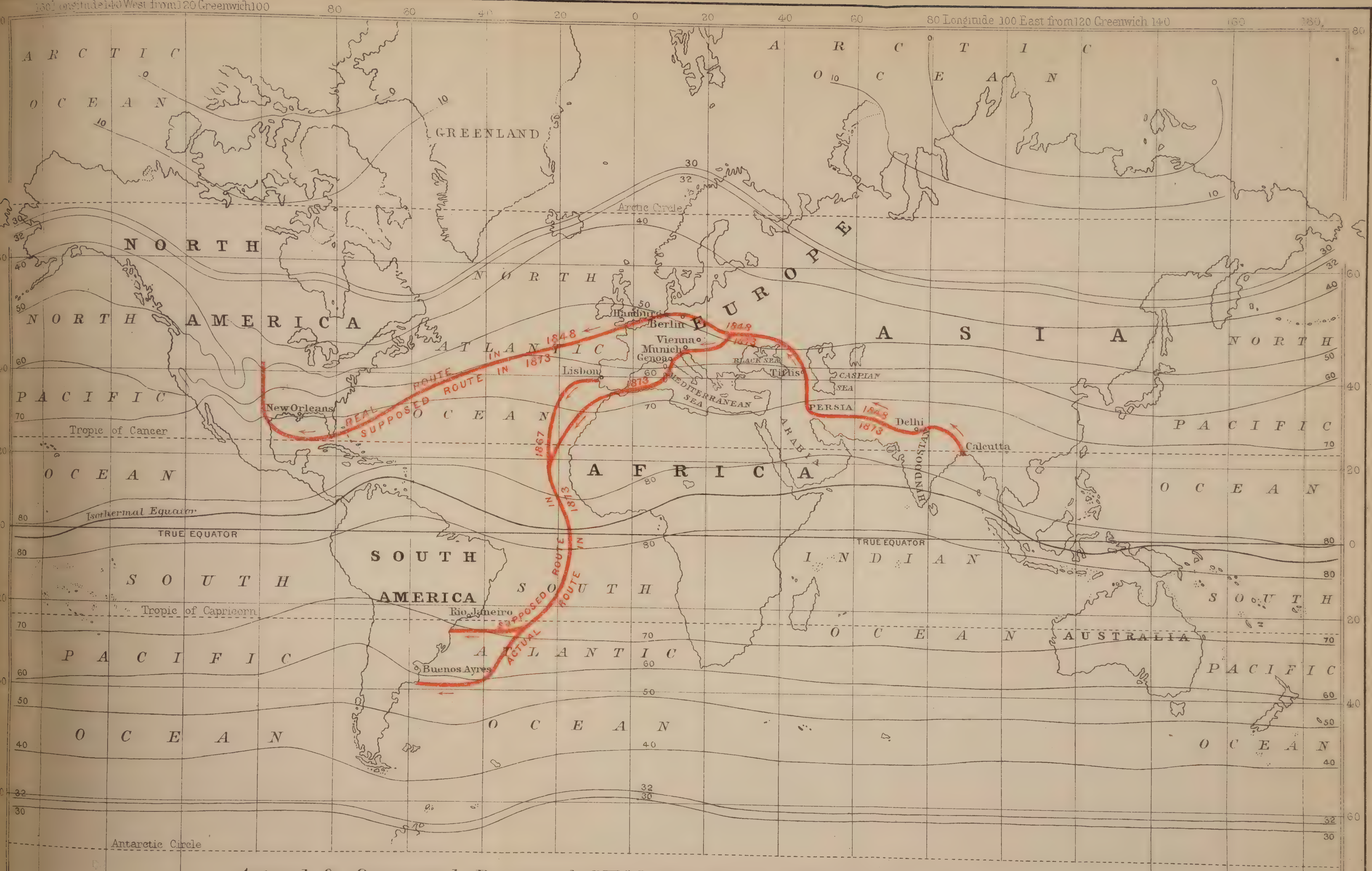
Hindostan has peculiarities of season, climate, winds, and productions; and the Hindoos have anomalies of manners, customs, religious ceremonies, etc., which distinguish them from all other countries and peoples.

The marked feature of its seasons is that the southwest and northeast monsoons blow each for six months in the year, and regularly succeed each other. The southwest monsoon blows from the eastern coast of Africa and the Indian Ocean over the western or Malabar coast of India, from April until about the close of October, and across India to the northeast, towards China. The northeast monsoon begins about the end of October in fitful squalls until the end of November, when it regularly sets in and continues until the beginning of April, blowing against the eastern or Coromandel coast of India, athwart India towards Madagascar and the southeastern coast of Africa.

Hence the influence of these regular winds would be to drive cholera, if it existed in a malarious form in the air, towards China for six months during the year, and towards the southeastern coast of Africa during the remaining six months. The disease will scarcely ever be blown towards the northwest, which is the direction in which it most frequently advances. Trade, travel, and pilgrimages take the northwestern route, and serve to explain the advance of cholera in that direction.

In the neighborhood of Calcutta there are three hot and *dry* months, namely, March, April, and May, in which nearly 48,000 deaths from cholera have occurred in the course of ten years. Three hot and *wet* months, namely, July, August, and September, with only 11,000 deaths. Three cold and *dry* months, namely, November, December, and January, with 24,000 deaths. And three transition months, with 22,000 deaths.

Macpherson (see "Cholera in its Home," page 6) says: "It is clear that the three hot and *dry* months [while the wind is blowing towards China] produce fully four times as many deaths by cholera as the three hot and wet months, and about twice as many deaths as the cold and dry months; while the cold and dry months slightly exceed the transition months in their number of casualties."



Actual & Supposed Routes of CHOLERA from HINDOOSTAN to EUROPE
and to
NORTH & SOUTH AMERICA IN 1848, 1867 & 1873.
by JOHN C. PETERS, M.D.

The waved black lines are the isothermals. The numerals at their extremities indicate the degrees of mean annual temperature.

Cholera has followed the routes of travel and not the isothermal lines.

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The temperature in the hot and dry months is only three degrees greater than in the hot and wet months, but the rain-fall is ten inches per month less. Hence very heavy falls of rain appear to diminish the prevalence of cholera, and the drying process increases the disease. This seems to corroborate some of Pettenkofer's views on a large scale. In the hot and dry months the Ganges only disgorges 36,000 cubic feet of water in a second; in the wet months, 500,000.

The customs of the Hindoos are very peculiar in some respects. It is calculated that 150,000,000 of them always defecate on the ground; they have no privies or latrines, and even the native soldiers under British rule will not use them. A mutiny greater than that of 1857 might be produced if this necessary hygienic rule were rigidly enforced. Many thousands of tons of human excrement have thus been daily deposited upon the open ground for some thousands of years. Outside of the large cities of India the bulk of the people always dwell in villages of from 2,000 to 10,000 inhabitants, and from five to less than twenty miles apart. The result has been the accumulation of enormous amounts of fæcal matter, with a corresponding degree of saturation of the soil, and the consequent extensive pollution of water in every direction. The disinfection of India can only be a remote possibility, and Europe must make up its mind to be scourged by cholera from that prolific source for many years to come, unless she protect herself by quarantine and disinfection.

No human or animal compost is used in India for agricultural intents; it is all left upon the open ground where it is dropped. On the other hand in China and Japan almost everything is used for purposes of manure, but in China it is carried in open vessels and vehicles to the fields; whence dysentery and typhoid fever abound, while cholera never occurs unless it is imported from India. In Japan all filth is collected in closed vessels, and removed from all the towns and villages every night. Japan possesses the cleanest cities and the widest streets; and cholera, dysentery, and typhoid fever are almost unknown.

In China and Japan there are systems for the removal of excrement, and in both all human excreta are applied to the land as manure. But the Japanese are incomparably the most active, shrewd, and cleanly. Their streets are kept free from filth, and the houses, yards, and lands are preserved from pollution by most thorough arrangements. An army of scavengers is employed during the nights in removing the debris and excreta of the day. There are no water-closets, privies, or dung heaps, but closed vessels are always used. They not only clear away the night soil, but the droppings of animals, offal, and kitchen refuse; so that the poorest quarters of the cities are kept thoroughly clean. In neatness the Japanese are not surpassed by any people in the world, and *if cleanliness is next to godliness*, they deserve the palm. They all bathe every day, both masters and servants.

The Hindoos style their country "the land of the ceremonially pure," but it is really that of the detestably unclean; and their habits are so inveterate that nothing but the most arbitrary measures can ever eradicate them.

As regards the spread of cholera among the villages in India, Dr. White,

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of Assam, a devout believer in Cunningham and Bryden, is forced to admit (see "Sixth Annual Report of the Sanitary Commissioner with the Government of India," p. 8) that "the history of the outbreaks of cholera is the same in every case. A case of sporadic cholera occurs in a Hindoo village; the patient is placed in the *smallest and closest apartment* of the house; a *large fire is lighted*, and as many people, friends and relatives of the sufferer, as the room will hold, assemble and squat around him solely for the purpose of praying; as there is seldom, if ever, any attempt to administer remedies. The patient during this time is vomiting, defecating, etc., and *the fomites of the disease must necessarily be carried* off by the visitors to the crowded rooms and huts. After three or four days, five or six new cases occur, and so on daily, until it runs through the whole village or villages to which the persons first infected belonged. Its further progress is limited, or circumscribed by the rude system of quarantine maintained by the natives. As soon as it is known that any considerable number of fatal cases have occurred in any particular village, all the other places in the neighborhood cut off every intercourse with it. Although they may have very dear relatives living in it, they will not go near, nor allow any person from the infected village to enter their own; and so rigidly is this precaution enforced, that many instances are known in which persons approaching a healthy abode from one where cholera existed, have been violently assaulted."

Thus it will be seen that heat, filth, carelessness, and overcrowding are capable of making a non-contagious disease at least infectious. For Macpherson says (p. 20): "While admitting that it is impossible to resist the evidence that cholera is contagious at certain times, I must still assert that it is pestilent in a very slight degree in the better houses and general hospitals of Bengal." Again, ordinary dysentery is not contagious; but Professor McLean (see Reynold's "System of Medicine," p. 627) asserts: "Dysentery once established as an epidemic, is propagated by the effluvia from the evacuations of those affected in crowded hospitals. In most of the Hindostan barracks the latrines were so badly constructed, so injudiciously placed and so illy kept, as to aid materially in propagating both dysentery and cholera; by exposing the healthy to the effluvia arising from the evacuations of the diseased. He has seen these diseases propagated in hospitals by the practice of preserving the evacuations of large numbers of patients for inspection by medical officers at their morning and evening visits. No single measure of a preventive kind yet tried has exercised a more beneficial effect on the health of troops in India than the improvement which has been introduced in the position, construction, and care of barracks and hospital latrines.[1]

The filthy habits of the Hindoos have carried cholera to the "Hill Sanitaria" of Hindostan. Dr. McNamara (see "Treatise on Cholera," p. 262), says: "Simla is the most beautiful hill sanitarium in the world. It is placed

[1] According to Inspector General John Murray (see observations on the *Pathology and Treatment of Cholera*, 1874, p. 56); "Out of two hundred and ninety-one cases treated in the civil hospitals in Paris, from September 16 to November 10, 1873, one hundred and one, equal to thirty-five per cent., originated in the hospitals in patients under treatment for other diseases." There was probably less ventilation than in warmer weather.

7,000 feet up the Himalaya Mountains, north of Hurdwar. Scarcely a year now passes without deaths from cholera occurring at Simla, and in 1866–67 and 1868 it appeared in a deadly form. Nor can we wonder at this when as late as 1865 the sanitary commissioners inform us that the "sides of the hills were everywhere studded with human excrements, and the smells which arose in every direction were a disgrace to a place which professes to be an asylum for the sick. The water was contaminated. In summer the dry beds of the mountain torrents are places of convenience and filth. The edge of a hill at a few yards' distance from the public road was lined with filth, and evidently the resort of the numerous native servants of the locality; and at some distance lower down the slope, is the spring from which the water supply of the summer residence of Her Majesty's Viceroy and many of the largest and best English houses in the vicinity is drawn. What must occur after every fall of rain is too obvious. Dr. Murray has made an elaborate series of analyses of the waters of Simla, which are naturally the purest he has found in India; but as it reaches the consumer, it is the most impure he has ever analyzed. The amount of nitrates in it is something appalling."

In no other country in the world are the pilgrimages so vast and numerous; and if cholera be portable at all, it must be carried about by the thousands and millions of pilgrims who annually traverse Hindostan in every direction.

These pilgrimages take place from Juggernaut to Calcutta, and along the whole course of the Ganges, which runs from the southeast to the northwest, through Patna, Benares, and Allahabad, up to Hurdwar, at the source of the Ganges, in the Himalaya Mountains. At Hurdwar, upwards of one half million pilgrims assemble on the 12th of April each year, and at least three millions every twelfth year. Lieutenant Bacon says: "On the road before us and behind, as far as the eye could reach, was a continued flood of human beings, rolling on toward the Ganges. Every avenue was crammed; every inch of ground was occupied. The uproar and effluvia were intolerable, and the disgusting spectacles which are only too frequently exhibited, were almost sufficient to deter any one from revisiting such a scene."

According to Lieutenant-colonel Sir Alexander Burnes (see "Narrative of a Journey to and Residence in Cabul in 1836, '37 and '38," p. 77), the most extensive arrangements have long been made to convey pilgrims, merchandise, and disease to and from Hurdwar and Central Asia. "The Lohanee Afghans are a migratory, commercial, and pastoral people, who proceed annually into India to purchase merchandise. At the end of October, as winter approaches, they descend into India, remain until after the Fair at Hurdwar, and commence their return towards the end of April. They all reach Cabool and Kandahar by the middle of June, in sufficient time to dispatch their investments to Herat and Bokhara; and then pass on into Khorassan in Persia, where they remain during the summer. They march in three great divisions; the first has twenty-four thousand camels, the second nineteen thousand, and the third seven thousand. It is with these that the Hindoo merchants, and foreigners generally travel. This channel of trade is very ancient, dating before the time of the Emperor Baber, in A. D. 1505."

The arrangements for the conveyance of pilgrims, merchandise, and disease farther west, are still more complete, according to Sir James Connolly. Due west of Herat, lies Meschid, the *Holy City* of North Persia. For eight months in the year all the roads to and from Meschid are thronged with pilgrims. Nearly sixty thousand come up from India, Cabool, and Afghanistan, and as many more from Turkey in Asia, the Caucasus, and shores of the Black and Caspian seas.

The great Hurdwar epidemic of 1867 is well known; over forty-three thousand deaths occurred then in the Punjaub from cholera. MacNamara (see "Treatise on Cholera," p. 251, 1869) says: "The epidemic crossed the western frontier of India into Afghanistan with fearful virulence in July, 1867, and continued until the month of September. It appeared in Teheran towards the close of 1867, where it was also reproduced in 1868." At that early period, MacNamara said: "Europe, therefore, is threatened with the disease, via Russia and Turkey."

Henry Blanc, Surgeon Major of the Indian Army, says (see "Cholera; How to Avoid and Treat it," p. 10): "From Peshawur (northwest border town of India), the disease crossed over into Cashmere and Afghanistan, where it broke out with violence in July, 1867, and did not cease until September. Towards the end of 1867 it reached Persia, where it remained until the autumn of 1868."

It is also well known that there was another great outbreak of cholera in the Punjaub or Northwest Province of India in 1869; over ten thousand deaths occurred from cholera (see "Sixth Annual Report of the Sanitary Commissioner with India," p. 33). "It prevailed in July, August, September, and October, 1869. Drs. Cunningham and Bryden have most carelessly assumed that the disease of 1867 was blown only over the borders of India in 1869, and by a monsoon, which does not blow in that direction at this season.

Dr. Bryden says:[1] "The cholera of 1869 did not stop on the Peshawur tier in the first week in September. We hear of it above the Kyber pass at Jellabad, and before the middle of September its appearance in Cabul was reported. On the 21st of September, 1869, it had again been so long in Meschid that from fifty to sixty cases a day were occurring. And far beyond, from the shores of the Caspian Sea, the arrival of cholera at Astrabad was announced. The English political agent at Astrabad writes, 'It first broke out among the soldiery and irregular cavalry. These being dispersed it spread in the town, and was very virulent. Those who can afford it have left the country.'"

The Caspian Sea is now covered with Russian steamboats, which can convey the disease rapidly in various directions. The cholera which was in Teheran, the capital of Persia, in 1867, would almost certainly reach Russia in 1868. Bryden says: "This cholera finds its termination neither at Astrabad, nor Meschid. Cases of cholera occurred at Kiev, the holy city of Russia, early in July, 1869, but there was no epidemic until the middle of September. At first it was supposed that the cholera had reached Kiev, from Persia, but it appears this year (1869) Tiflis has been unusually

[1] See "*Statistical Report of Cholera in India in* 1869," p. 220.

healthy." But the Teheran cholera of 1867 and 1868 probably reached Tiflis in 1868, in time to be forwarded to Russia in 1868 ; and doubtless Drs. Tholozon and Pelikan have entirely overlooked the cholera of 1867 in Persia, and merely deny its existence in Tiflis in 1868.

However this may be, the epidemic of 1865 and 1866 in Russia left that country with 33,382 cases in 1867. In 1868 there were about eighty-three attacks in all Russia ; and in 1869 only nine hundred and eleven cases, and the majority of these were in the holy city of Kiev on the river Dnieper ; to which at least 50,000 pilgrims come yearly, some of them on their return from Jerusalem, and the holy places in Syria and the Caucasus.

It is not only highly probable, but almost certain that the Hurdwar epidemic of 1867 reached Russia by way of Persia, in 1868 and 1869, so that in 1870 there were 20,140 cases reported. The Punjaub epidemic of 1869 was soon added thereto, and in 1871 there were no less than 305,229 deaths from cholera in Russia. At least Dr. Flauvel, one of the most competent of the French historians of the course of cholera, says that in 1869 and 1870, Poti, on the eastern coast of the Black Sea, Kertch in the Crimea, Taganrog on the sea of Azof (the first southern Russian port that is cleared of ice in the spring), and Rostoff on the river Don, were among the earliest Russian cities to be visited by cholera. He says : " As usual the rapid propagation of the disease along the coast of the Black Sea, coincided with the arrival by steamships of travellers from infected points. No less than seventy infected vessels arrived in the Bosphorus, and Constantinople was soon attacked."

The river Dnieper upon which the holy city of Kiev is situated, is connected by canals with the rivers Niemen and Vistula, and in this way cholera was brought through Poland up to the Baltic cities of Konigsberg, Dantzig, and Stettin, by Polish raftsmen in 1870. There were many attacks in Poland in 1870, 1871, and 1872 ; and in 1873, there were 37,586 cases and 16,248 deaths. It prevailed in Konigsberg, Dantzig, and Stettin, in 1871, 1872, and 1873. In 1871 there were over 3,000 cases and 1,800 deaths in these Baltic towns ; more in 1872 ; and 8,669 cases and 5,057 deaths in 1873. In Galicia two hundred and twenty-four towns and villages were attacked.

There was a slight epidemic in Hamburg in 1872 ; and 1,225 cases and 877 deaths in 1873.

There were 140,000 deaths from cholera in Hungary in 1872 and 1873 ; and many in Austria, Poland, Bavaria, and Italy. There were nearly 27,000 deaths in Prussia in 1872 and 1873, of which 788 occurred in Breslau, 2,587 cases in Dantzig, 5,277 cases in Konigsberg, 7,120 cases in Magdeburg, and many others in Warsaw, Berlin, and Dresden.

It was almost a matter of course that cholera would be exported from Europe in 1873 ; it is even positively proven that it was conveyed from Genoa in Italy by two steamships down to Rio Janeiro and Buenos Ayres.

Many of the first cases which occurred in New Orleans have been traced to persons who worked among the shipping on the levee, although they died in various distant parts of the city. The importation into Nashville has been positively proven as having occurred from Memphis ; and the arrival of the disease in Memphis from New Orleans is scarcely more doubtful than that of yellow fever, which is regarded as absolutely certain. In Cincinnati, cases

had occurred and had been exported to Wheeling, West Va., before any had been reported in the former city. Cases were sent direct from New Orleans and Memphis up to Chicago as early as May, 1873.

Great mistakes and confusion have arisen in New Orleans, Memphis, Nashville, Cincinnati, and other places, because careful examinations into the origin of the disease were not instituted until weeks and months after cholera had commenced or even terminated in those cities; and then the fatal cases only were more or less accurately recorded. It would be quite as impossible to trace the course of scarlet fever, if none but fatal cases were counted. Thus in France, in 1866, only ninety-five thousand cases proved fatal out of two hundred and thirty thousand; hence according to the New Orleans and Cincinnati plan one hundred and thirty-five thousand facts would have been suppressed or overlooked. When all the non-fatal cases are omitted it frequently happens that there is no apparent, or easily traceable connection between the fatal ones; and it seems like going back to the *dark ages* of medical research to parade lists of fatal cases only of cholera, and to refer to them as containing all, or even the principal part of the facts descriptive of an epidemic.

The marked resemblance between the progress of the great epidemic of 1841 to 1849, with that of 1867 to 1873, has impressed many. The huge twelfth year Juggernaut epidemic of 1841, in India, was supplemented by an equally great Hurdwar outbreak in 1843. According to Professor Dickson,[1] in 1844 it was known to have made an encroachment upon Afghanistan, where its ravages were considerable. In May, 1845, it was at Kandahar, carrying off three hundred victims a day. In June, at Cabul; in July, at Herat. Some pilgrims going to Meschid, carried it to that city in February, 1846. From Meschid it traversed Persia from east to west, following the great roads; reaching Astrabad in May, 1846, and Teheran in June, 1846; carrying off seven thousand persons in seventy days. It is significant that in 1846 and in 1831, cholera appeared at the precise time when the pilgrims were flocking in from all sides. At the same time following the west coast of the Caspian Sea, in November, 1846, it invaded the Russian provinces, attacking the same towns as in 1823 and 1831. Here it stopped at the end of the year 1846, and took up its winter quarters upon the frontiers of Europe. For several months nothing was heard from it; there were indeed some moments of hope that it had disappeared entirely. But this illusion did not last. At the end of March, 1847, it started from its short sleep and reappeared on the shores of the Caspian; in May, 1847, it was among the Kossacks; in July at Astracan; on July 21, at Taganrog on the sea of Azof; at Kherson at the mouth of the Dnieper; then at Kiev; and from there down to the Baltic. It arrived at Hamburg in August and September, 1848; and at New Orleans by three ships from Hamburg and Bremen, in December, 1848.

In the "Bavarian Official Report," p. 14, it is stated that in two hundred and fourteen towns and villages importation of the disease could be proved, and that in eighty-one it was not. It is highly probable that intelligent and industrious investigators will find importation in all instances.

[1] See *New York Journal of Medicine*, January, 1849, p. 9.

PRACTICAL CONCLUSIONS CONCERNING CHOLERA. — EVIDENCE RESPECTING CAUSES AND PREVENTIVE MEASURES.

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Cholera has prevailed extensively in the United States during eight out of the forty-one years since its first appearance upon this Continent. But in only four out of the eight years, as we have reason to conclude, was this pestilence freshly introduced to the United States from Europe. The new importations of the exotic germinal cause were abundantly witnessed in the years 1832, 1848–49, 1854, 1865–66. The arrival of emigrant ships and large companies of emigrants infected with cholera late in Autumn and early in the Spring, in the second and the fourth of these visitations became associated with the most definite and unquestionable of all the evidence we have witnessed upon this Continent respecting the direct dependence of the cholera in America upon cholera in Europe.

Looking back upon the historical records of Asiatic cholera they now appear to be entirely consistent with each other in the successive epidemics, and in all the countries visited by it. Exceptional instances of its outbreaks or of unaccountable security from its propagation, which have puzzled numerous persons who have theorized concerning the causation and habits of this pestilence, need not and do not interfere with or prevent the most exacting and logical studies and deductions relating to the epidemic phenomena, the essential factors of causation, and the natural laws of this destructive disease. All human experience during the past fifty years teaches the same uniform lessons concerning the sanitary and preventive measures that have been found available in staying the progress and fatality of this destroyer; and whether these lessons were taught by mere experience and empirical observation, or by experiment and the most logical deductions of sanitary science, they are found to harmonize with each other. The vexed questions relating to personal contagion and of contingent transportability cease to be regarded as exclusive causes when the total history of any one of the great pandemic marches of cholera comes under review. Each of the essential factors of causation comes into view more or less distinctly, and in the broader studies of successive epidemics these factors admit of clearer and clearer definition, while the total phenomena, with the best grouping which the events of the pestilence admit, prove that the cholera is governed by natural laws which are becoming sufficiently well understood to give as great exactness to sanitary measures against it as can be given to the preventive measures against any other epidemic kind of disease.

The eight distinct periods of widespread epidemics of cholera in the States of North America have been associated with similar periods of its prevalence in Europe, and, as Mr. Simon, the profoundly versed hygienist of the Privy Council of England has remarked of the cholera and other infectious epidemics upon the continent of Europe and in Great Britain, so it may be said of the cholera in America; — namely, that "contagia which are current on the continent are current here," — so that practically it matters not that all the officers of health and all the waterside police of the commercial countries which interchange the germinal contagia or infection of diseases after all have utterly failed to detect with certainty the individuals or the ships by which the disease arrived and gained its first foothold. Yet, fortunately for the general demonstration of the truth concerning the transportation of the germinal cause of cholera, there have not been wanting many well attested instances of such transportation of the disease by persons arriving from infected places with cholera. The speedy and destructive following of this disease in localities so visited by its carriers, and the successive stages of distribution from the foci thus established, while all other places enjoyed entire immunity, has, in a vast number of instances, clearly proved all that can be logically required in the line of events which would be mathematically and logically probable concerning such directly traceable events in the chronology of a pestilence which for its propagation depends upon several factors, only one of which is germinal or infective. The events at the little port of Sunderland in England in 1832 and 1848, at Liverpool and Bristol in 1866, at New Orleans, and the Mississippi River landings in the winter of 1848–49, and the repeated illustrations in the chief ports of the Red, the Mediterranean, the Black, and the Caspian seas; and especially the history of this disease upon the island of Sicily in 1866, and both by and among the United States troops in 1866 and 1867, as faithfully portrayed in the two official reports issued by the Surgeon General of the Army.[1] Fortunately for mankind the complex elements of great truths and the relationships of comprehensive principles in relation to the causation and the prevention of a pestilence so destructive and so vitally important for the lessons and warnings it gives, has not been found wholly obscured in mysterious uncertainty as regards its causation and the natural laws or conditions which govern its propagation. Though spread from country to country by human intercourse, its propagating or germinal attribute is now known to be so largely dependent upon local and variously contingent circumstances that the precise knowledge of these collateral or circumstantial conditions has been matter of chief concern and sanitary treatment.

At the port of New York more conspicuously than at any other great centre of population and commerce, the fact has been completely demonstrated that the arrival of persons sick and dying with Asiatic cholera, and the arrival of ships infected with cholera, presumably and in such a degree as ships may be actually infected or be the carriers of cholera infection, do not and need not inevitably or even usually be the harbingers of an epidemic of the disease. In no less than sixteen years out of the last forty-one, and even for

[1] *Circulars* No. 5, 1867, and No. 1, 1868, *War Department, Surgeon General's Office.*

the half century, have both ships and emigrants with cholera arrived and been brought under sanitary treatment at the Quarantine establishment of the State of New York. In four of the sixteen years it is not doubted that cholera spread from such *importation* of a germinal cause, but after a careful and most scrupulous study of all the facts which have been accessible to the writer, there seems to be no probability that cholera was spread extensively from ships and persons arriving at the port of New York in any other than the years 1832, 1848–49, 1854, and 1865–66. It is not proved, by any line of direct evidence, that the epidemics of the years first mentioned actually depended upon fresh importations, but we are warranted in stating that the events which occurred in the years last mentioned at the ports of New York, Quebec, and New Orleans fully warrant the conclusion that the exotic cause of the disease was distributed from these ports. From the beginning of June until the succeeding autumn, in the year 1832, ships freighted with emigrants sick with cholera continued to arrive at the ports of New York and Quebec, and as they speedily dispersed upon every line of travel throughout the States, the cholera attended them, and in their wake it followed as an epidemic. Whether by the canal barges, crowded with these emigrants, which left the port of New York for the western canals, or by the boats from Quebec for Champlain or the western lakes, the immediate following of cholera and the creation of vast numbers of new foci for the epidemic, became the very first line in the history of the epidemic in America. Again in 1848–49, beginning at New Orleans immediately upon the arrival of cholera-infected emigrants from Havre, in December, 1848, the epidemic took its course up the Mississippi and its great tributaries, and in a single fortnight, at dates which in each river port corresponded with the first week after the arrival of steamboats with the first cholera patients on board, the disease made its outbreak. In river towns a thousand miles distant from each other, the epidemic made its appearance at the same time in those instances in which the first cholera patients arrived by the steamboats in the respective localities at about the same date. Surviving the winter, the propagating attribute of that great epidemic continued its ravages during the years 1849 and 1850. But from the ports of New York and Quebec no extension of cholera was propagated until the succeeding month of May, when the events of 1832 were repeated.

The events of 1854 repeated the historical and epidemical facts of 1848–49. The numbers of infected ships and cholera-sick emigrants were scarcely less than those of the latter period. But it was noticeable that the propagation of the disease and the establishment of new points of epidemic prevalence and departures were apparently less certain to ensue upon the arrival of persons sick with cholera in distant localities. But if it was less virulent as a pestilence in 1854 it still evinced its attributed power of germinal propagation throughout a longer period without exotic renewal. It spread to Central America and up and down the Pacific coast, and was repeatedly re-imported from Central America (by way of the port of Aspinwall) to the Quarantine grounds on Staten Island, and there renewed its locally epidemic phenomena by extending its destructive power throughout the greater portion of that

area of thirty acres, but chiefly in the hospital buildings occupied by convalescents from fever and by the sick or convalescents of small-pox. The writer of this paper and the late Dr. Alexander F. Vaché, his official predecessor in the superintendence of those hospitals and grounds, were witnesses of these events.

The events of 1865–66 are fresh in memory, and their historical record is remarkably clear and instructive. That record needs no recital in this place. Interpret it as we may, the successive and widely diversified and distantly separated events in the experience of that visitation of cholera demonstrated the practicability of dealing with the transportable and exotic or germinal factor of the pestilence as an enemy to be held in restraint, and its propagating attribute to be destroyed — a pestilence to be *stamped out* by definite hygienic means. The local factors of epidemic cholera, the environment which insured the fatal sweep of the pestilence in 1832, 1848–49, 1854, and 1866, have been everywhere correctly described; as to these local circumstances they were the same in the ten other years in which cholera patients arrived at the Quarantine grounds in the port of New York, but which arrivals were followed by no extension of the disease over this country. The one great and determining fact in regard to the epidemic or the non-epidemic following in the fifteen years in which persons sick and dying with Asiatic cholera were brought into our port is this, namely, that in the epidemic years the number of such sick and dying emigrants arriving in port was enormously larger, and the number of persons infected with cholera who failed to be detained and prevented from travel beyond the harbor of New York admits of no estimation, because the condition of dangerous infectedness admits of no positive definition within the limits which must, in the travel and business of the world be overpassed, by multitudes of travellers, as respects any external sanitary restrictions in the chief ports and commercial towns.

The prevalence of cholera throughout a vast extent of the great River Valley of the West in the year 1873 has confirmed the belief that the direct connection between a great epidemic of this pestilence and any exotic source at a particular port or place to which it was introduced may not in every epidemic be ascertained. Even if the time of connection with an *exotic* germinal cause were never discovered, it is important to be accurately informed if any infectious property pertained to this last epidemic, as well as to know, also, if the circumstances of localities and of the season were particularly characterized in any such way as to indicate definitely the sanitary conditions of exposure to or of protection from an outbreak of cholera. Viewed in this aspect the inquiries as planned by the American Public Health Association, and patiently pursued by two of its members, Dr. Ely McClellan, Assistant Surgeon United States Army, and Dr. A. B. Judson, whose contribution of reports to this Association bear testimony to the great value of such voluntary researches, will henceforth be esteemed of great value in epidemiology. Though the exact line of relationship between this remarkable visitation of cholera and an exotic source may not be discovered or may not in fact exist, still the epidemic has conformed to such laws and habits, and has illustrated such truths in the causation and progress of a destroying pestilence that it is plainly a duty of the Association to publish the results of this great inquiry.

The prevalence of very destructive epidemics of cholera in limited districts, without a completely demonstrated connection with an exotic germinal cause has been witnessed in several instances in the United States. Such, for example, was the epidemic in Wheeling, West Va., in 1833; in Cumberland, Md., and in Pittsburg, Pa., at a later period; and in the widely extended but strikingly localized epidemic which in 1852 prevailed in numerous places in Illinois, Indiana, Kentucky, and Tennessee.

The epidemic of 1873 has differed chiefly from those last mentioned by the vastly greater extent of its prevalence. Already its ravages have been definitely reported in more than two hundred places in no less than thirteen States of the Union; and concerning these and many other instances of the somewhat limited prevalence of epidemic cholera, we may be compelled to believe that no direct and completely unbroken line of dependence upon an Asiatic and trans-European communication of the exotic element of causation is likely to be demonstrated. Yet the careful students of cholera epidemics will not be unprepared to believe in such a line of connection if even the first connecting link in the chain of events in the epidemic should be ferreted out at New Orleans as the first, and, as now appears to be probable, the only American port from which cholera took an epidemic departure into the interior States. That first, but, up to this date, that undiscovered link in the chain of events which would connect this cholera epidemic of 1873 in the Mississippi Valley with that which for a year has ravaged the provinces of southern Russia, and swept through Hungary and Austria, may never be found, and though there may be very great probability that such a connecting event has occurred, is not necessary to the etiological history of this cholera if, as Dr. Pelikan of Russia, and Dr. Tholouzan of Persia believe, the exotic germinal cause of cholera actually survives, through succession, years after being introduced to foreign lands and to climates as inhospitable as those of Russia and the Danubian provinces. We state this hypothetically, and certainly we need not regard it as an essential matter, because the proof is so conclusive upon the affirmative side of the question: "Is cholera dependent upon a transportable germinal factor as an essential element in the causation of its epidemics?" But in a great number of instances in which diligent investigation has been made concerning the causation of the most isolated outbreaks of cholera, the fact has been ascertained that even in such cases the line of connection and transportation may be complete and indisputable. This has been found true in a vast majority of the instances in which this kind of investigation has been practicable.

The enlargement of the question, "Is the outbreak of pestilential cholera in any place in America to be attributed to the exotic germinal cause that sprang from India?" must be so extended as to embrace the still unanswered query, How long, and in what places may the exotic and infecting elements of the cause of epidemic cholera linger and exercise their propagating power?

At last the probability which had all along — from 1832 until now — been admitted, has become an almost indisputable certainty, that this propagating factor, which is exotic, does tend to fix itself in certain localities in such manner as to survive during successive years in countries beyond the limits of the

native habitats of the cholera. This conclusion, which Dr. Pelikan, the eminent head of the Sanitary Service of Russia, has announced as a logical deduction from comprehensive and thorough investigations respecting the course of various epidemics and local outbreaks of the disease, is one of the most important of all the deductions in the half-century investigations into the laws which govern this pestilence.

Now without at once accepting this deduction of the very strongest kind of a probability as being a final settlement of the question of the survival and partial or temporary naturalization of the exotic pest which certainly originated in India, it is manifestly prudent to accept and act upon sanitary problems which this deduction from large and practical observations have seemed to force upon us. This certainly is prudence, for the fact, which holds true the world over, that the places and local conditions of unhealthfulness which not only are the hot-beds of cholera when epidemic, but which nurture and preserve its germinal cause whenever and wherever it survives from one year to another, are such places and environments as do most harm to the general health of the people who dwell therein ; and, consequently, whatever sanitary proceedings may be enforced to reform them, by way of guarding against the cholera and its germinal forces that survive through inactive periods — whether they be periods of cold or of drought — will prevent not only the resuscitation of such pests, but will at the same time extinguish the local and general causes of enteric fevers and diarrhœal maladies, and thereby very greatly and permanently promote general healthfulness.

The fact that in the eastern and southern provinces of European Russia, and throughout the Danubian regions, and so on eastward to the Caspian Sea, the exotic germinal cause of cholera seems to survive through two or three years is, perhaps, less singular than would be its survival through successive seasons in any portions of the United States,[1] for the former are nearer the routes and sources of frequent renewal of the transported cause. But there is, even in these United States, so much evidence of the survival and lingering of the exotic factor of the epidemic through two or more years that as the case now stands, Dr. Pelikan's view of this subject would seem to be the correct one.

Whether, therefore, the fearful possibility of the revivification of cholera, or the strong probability of damage from the local sources of fatal fevers and enteric maladies incite the needed sanitary activity, the extinguishing of all collateral causes, and the removal of hot-beds and nurseries of the cholera germs, are public obligations which no community can be justified in neglecting. In thus giving reasonable credence to the presumption that the exotic factor by which the Asiatic cholera is introduced and spread widely upon the

[1] This ability and tendency to survive is characteristic of nearly if not quite all the pestilential poisons. Even the germinal attribute of the yellow fever infection, as well as that of relapsing fever, and most conspicuously those of typhus, typhoid, and the exanthematous fevers do so survive if helped by local circumstances. Cholera and the enteric fever called typhoid are so allied in the kinds of soil and the filthy surroundings in which each of them is most rapidly propagated and fostered that we do no violence to the logical principles of etiology when we accept this doctrine of survival and recrudescence of the germinal attribute or factor of epidemic cholera.

continents beyond the peninsula of India survives through successive years, we do not wholly dismiss from the mind the possible discovery of circumstances which must modify that hypothesis. It is chiefly important that all sanitary authorities should clearly understand the ascertained facts concerning the causation and epidemic propagation of this Asiatic scourge, and that they promptly deal with them by the most effectively preventive means.

The three great conferences or conventions which have been convoked by the students of cholera epidemics, and the doctrines of hygiene, namely, the Cholera Conference, so called, at Constantinople in 1866, that at Weimar in 1867, and the International Sanitary Congress at Vienna in 1873, have most conspicuously, and without any predetermination or concert of action, by the successive congresses, arrived at, and promulgated the same essential conclusions and the same formulas of advice in respect of preventive sanitary measures and the means for extinguishing or controlling the disease.

The International Conference at Constantinople, it will be remembered, was convened upon an official solicitation issued in the autumn of 1865, by M. M. Drouyn de l' Huys, Minister of Foreign Affairs, and Armand Behic, Minister of Public Works of the French Empire. The session of that Conference opened on the 13th of February, 1866, and was closed on the 21st of May. The thirty-three propositions upon which the conference announced definite conclusions respecting the origin, endemicity, transportability, and propagation of cholera.

These conclusions, and the precise questions to which they relate may be concisely stated as follows : —

I. *Where did the Cholera, known as Asiatic, originate, and where is it now endemic?*

Conclusion: Asiatic Cholera, which has at different times run over the whole world, had its origin in India, where it had its birth, and where it exists as an endemic.

II. *Except in India, does the Asiatic Cholera exist in any part of the world in an endemic form?*

The invading Cholera has always come from abroad and has not been spontaneously developed in the countries enumerated, except in India.

III. *Is there reason to believe that Cholera may acclimate itself in our countries?*

The Commission regards it as problematical without rejecting the possibility of the fact.

IV. *Is there in the Hedjez an original focus of Cholera, periodic or permanent?*

It appears, up to the present time, to have been always imported from without.

V. *Are there certain localities in India particularly favorable to the development of Cholera, or exclusively generating it?*

There are in India certain localities, principally in the valley of the Ganges, where Cholera is endemic.

VI. *Do we know the concurrent causes by which the Cholera originates spontaneously in India, and the circumstances which make it take on an epidemic character?*

The permanence of the disease in certain localities should be explained only by something inherent in the places themselves. We do not know the special conditions under the influence of which Cholera originates as an endemic.

VII. *What are the circumstances which concur in the development and propagation of the epidemics of Cholera in India?*

The most powerful of all the causes are the pilgrimages.

VIII. *Is the transmissibility of Cholera proved?*

The transmissibility of Asiatic Cholera is an incontestable truth.

IX. *Are there conclusive facts which force us to admit that Cholera can propagate itself to a distance by certain states of the atmosphere, by winds, or changes of the surrounding medium?*

No fact has proved that Cholera thus propagates itself.

X. *How is its importation effected, and by what agents transmitted?*

Two conditions are necessary; an arrival from an infected district and circumstances favoring transmission.

XI. *Under what conditions does man import Cholera?*

Man affected with Cholera is himself the principal agent in propagating the disease, and a single cholera patient may cause the development of an epidemic.

XII. *Conclusion:* Facts tend to prove that a single individual (and with much greater reason, many) coming from an infected place, and suffering from diarrhœa, may give origin to a Cholera epidemic, in other words that the premonitory diarrhœa may transmit Cholera.

XIII. *What is the length of the period of Incubation?*

It does not exceed a few days.

XIV. *Can Cholera be imported and transmitted by living animals?*

It is not known.

XV. *Can Cholera be imported by clothing and articles in common use?*

Cholera may be transmitted by such articles coming from an infected place, especially by those which have been used by a Cholera patient.

XVI. *Can Cholera be imported and transmitted by merchandise?*

The affirmative and negative votes of the Commission stood sixteen to six.

XVII. *Can the dead bodies of Cholera patients import and transmit Cholera?*

It is prudent to consider them as dangerous.

XVIII. *What influence do the different modes of communication, by land or sea, have upon the propagation of Cholera?*

Maritime communications are, by their nature, the most dangerous; next come those by railroads.

XIX. *What influence have deserts upon the propagation of Cholera?*

The Commission believes that this disease has not been imported into Egypt or Syria across the deserts by caravans from Mecca.

XX. *What is the influence of crowding together of human beings on the intensity and propagation of Cholera epidemics?*

The rapidity of the extension of the disease is proportionate to the concentration of the aggregated mass . . . . in a dense crowd the more rapid the extension the more prompt is the cessation of the epidemic.

XXI. *What is the intensity and the tenacity of Cholera epidemics on shipboard?*

The intensity is in general proportionate to the crowding; and the Commission adds: "The danger of importation by vessels and of giving rise to an epidemic are not entirely dependent on the intensity of the epidemic on board."

XXII. *What influence does an accumulation of persons in lazarettos (from a focus of Cholera) have upon the people so detained?*

Such accumulation and detention have the effect of extending the disease among the inmates.

XXIII. *What influence do armies, fairs, and pilgrimages exercise upon the propagation of Cholera as an epidemic?*

They are among the most certain means of the propagation of Cholera, and they constitute great epidemic foci.

XXIV. *What is the influence of dissemination on the intensity and development of Cholera?*

The dissemination (of infected persons) gives rise to great danger of propagating it, but may render less violent an epidemic that has appeared in a crowd.

XXV. *What share does the pilgrimage of Mecca take in the Cholera epidemics?*

Twice this disease has been imported into Egypt and countries bordering on Europe by the pilgrims.

XXVI. *What are the assisting causes of Cholera?*

Misery and its consequences, the crowding of individuals, impaired health want of ventilation, emanations from soil impregnated with organic matters, especially from Cholera dejections, the sewers, privies, and contaminated water. The soil of a locality once impregnated with Cholera dejections, is able for a considerable time to retain the property of disengaging the principle of the disease and thus keeping up an epidemic.

XXVII. *How is immunity from the Cholera to be understood?*

There exists in a healthy man a resistance capable of neutralizing the toxic agent; and that this resistance, weakened among miserable populations and in individuals debilitated by any cause, may, by the increase of easy circumstances and by good hygienic measures, be generalized to the point of rendering Cholera a disease but little to be feared. But, unfortunately, we are far from this, and it is for this reason that measures of isolation are, and will yet be for a long time, necessary.

It must be very well known that Cholera, although transmissible, does not attack fatally all the individuals exposed to its influence; that a well-regulated life, good hygienic conditions, are almost certain guaranties against its action; that it rages by preference in unhealthy localities, among populations weakened by misery and among individuals undermined by disease or excess.

The immunity which certain localities enjoy, that is to say, the resistance, permanent or temporary, general or partial, opposed by these localities to the development of cholera within their limits, is a fact which does not exclude transmissibility, but which indicates that certain local conditions, not yet entirely determined, are an obstacle to the development of the disease.

In the same way the immunity, more or less complete, and more or less durable, which the majority of persons in the midst of a focus of Cholera enjoy, an immunity which attests the individual resistance to the toxic principle, is a circumstance to which we should attach the highest importance.

In the point of view of epidemic development, it is the corrective of transmissibility; and viewed with regard to prophylaxia, it sets in operation proper means to arrest the ravages of the disease.

XXVIII. *From the facts which relate to the genesis, the propagation and the transmission of Cholera, can we draw any precise conclusion with regard to the generative principle of the disease, or at least the media which serve as its vehicles or receptacles, the conditions of its penetration into the organism, the ways by which it passes out, the duration of its morbific activity, in a word, all its attributes a knowledge of which is important in order to guard against it?*

We can only frame hypotheses as to the nature of the generative principle of Cholera. We know only that it is a native of certain countries of India, and that it dwells there permanently; that this principle is reproduced in man, and accompanies him in his peregrinations; that it may also be propagated to a distance, from country to country, by successive regenerations, without ever being reproduced spontaneously outside of man.

XXIX. *What are the vehicles of the generative principle of Cholera?*

To this question facts answer, that the air is the principal vehicle of the cholera principle. The rapid spread of the disease in an infected locality; the simultaneousness of a great number of cases in a given assemblage of people, where mediate or immediate contact with those first taken sick was not possible; the general influence which in the time of an epidemic weighs more or less upon individuals placed within the limits of the infected district, all these circumstances prove, that, in fact, the surrounding air is the principal vehicle of Cholera. The principle of Cholera then is volatile, and acts in this respect after the manner of miasma; that is to say, by infecting the atmosphere.

XXX. *To what distance from a focus of emission can the principle of Cholera be transported by the atmosphere?*

The surrounding atmosphere is the principal vehicle of the generative agent of Cholera; but the transmission of the disease by the atmosphere, in the immense majority of cases, is limited to a very short distance from the focus of emission.

XXXI. *Besides the air, what are the other vehicles of the Cholera principle?*

Water and certain ingesta may also serve as vehicles for the introduction into the organism of the generative principle of Cholera.

This granted, it follows, so to speak, necessarily, that the passages by which the toxic agent penetrates the organism are principally the respiratory passages, and, very probably, also the alimentary canal. As for penetration through the skin, nothing tends to prove it.

Adopted unanimously.

XXXII. *What are the principal receptacles of the Cholera principle?*

The matter of Cholera dejections being incontestably the principal receptacle of the morbific agent, it follows that everything which is contaminated by

these dejections becomes also a receptacle from which the generative principle of cholera may be disengaged, under the influence of favorable conditions; it follows also that the production of the cholera germ takes place very probably in the alimentary canal, to the exclusion, perhaps, of all other parts of the system.

XXXIII. *What is the duration of the morbific activity of the generative principle of cholera?*

It results from the study of facts, that in the open air the generative principle of cholera loses rapidly its morbific activity, and that such is the rule; but that, under certain peculiar conditions of confinement, this activity may be preserved for an undetermined period.

The deliberations of the Cholera Conference at Constantinople partook largely of the nature of judicial proceedings in regard to the precise nature and weight of evidence. The interests of nations, the safety of armies, and the claims of humanity awaited, in some sense, the conclusions that were reached. Sanitary works, and not dogmas, were well defined in the thirty-three Conclusions of that Conference.

The Cholera Conference at Weimar was a voluntary convocation of scientific observers and students who, in numerous epidemics, had pursued their practical inquiries with all the zeal of naturalists, as well as with the noble purposes of public-spirited citizens intrusted with great duties. It assembled at Weimar in April, 1867, — forty-nine eminent medical men and sanitary officers joined in the deliberations, in which the observations, opinions, and theories of each gentleman were freely sifted and compared. The chief points which received full examination, and the bold declaration of opinion by the members in conference related to: —

(1.) The evidence of transmission of an infectious cause from place to place.

(2.) The uselessness of town quarantines.

(3.) The causes of local and house epidemics of cholera.

(4.) Causes for the immunity of particular localities and particular houses from the epidemic.

(5.) Certain relations of well waters, soils, localities, and seasons to the prevalence of cholera.

(6.) Observations relating to germinal causes and the several factors which act together in producing and propagating cholera.

Agreeing very generally with the conclusions announced by the conference of the previous year at Constantinople, the exceptional cases in cholera outbreaks were allowed such prominence as would tend to awaken renewed investigations and a broader study of the factors of causation. Conclusions were announced respecting the best preventive measures, and the means for extinguishing the active germinal or infectious attribute of the epidemic. The conclusions and recommendations relating to disinfectants, and the modes of their application were concisely given, as follows[1]: —

1. "The Conference expresses, as its deliberate conviction, that the efforts

[1] See *Report of the Cholera Conference at Weimar*, Munich, 1867.

to arrest and prevent cholera by disinfectants should be continued in the most energetic manner.

2. "Disinfection will be entirely successful only where excremental matters are carefully gathered and kept from being cast about; when attention is given to cleanliness and the means of health, and when the *disinfection is performed by sanitary authorities in a compulsory manner.*

3. "Wherever the entire locality or district cannot at once be disinfected, it is advisable to *disinfect throughout the places visited by the previous epidemics of cholera.*

4. "The general disinfection should be performed at the proper time, that is, before the epidemic is actually prevalent in the town or place. Every house or spot that becomes infected, or is suspected to be so, must be kept constantly under the influence of disinfectants.

5. "In regard to the best substances to be used as disinfectants, there have been found no more effectual materials than sulphate of iron (copperas) and carbolic acid; and, as experience proves, we have no other disinfectants that can be employed with greater facility. A combination of both these disinfectants is therefore recommended.

6. "The disinfection of clothing that has been infected by cholera excrement is especially an important matter. For that purpose, the Conference recommends that all such clothing be disinfected by boiling in water, or by chemical treatment in a proper solution of 'zinc vitriol' (sulphate or chloride of zinc); and the Conference also recommends that special arrangements be made by which disinfection can be employed in all places, and at any hour, especially among or for the poor.

7. "If cholera infects any house or spot, it is recommended that, if practicable, the houses so situated in an infected place, or being infected, should be vacated, and that their inhabitants should be removed from the infected spot.

8. "It is especially recommended that the ground-water about dwelling-houses, and all the grounds about buildings of every kind, should be kept undefiled by any excremental matter of cholera; also that all drinking-water be undefiled and pure; and where no pure water can be had, that such as must be used for drinking should be disinfected by boiling."

The International Medical Conference at Vienna, which was in session the first eight days of September (1873) during the Great Exhibition of Industry and Art, resulted in no new suggestion or decision respecting preventive measures against cholera. But after an animated review of evidence upon the chief questions concerning the propagation, and especially in regard to the utility of quarantine regulations, the whole discussion culminated in the unanimous reassertion of the transportability of that exotic germinal attribute or element of cholera which is always originally derived from its habitats in India. At the close of the discussions, and when ready to vote upon various resolutions that should set forth the views of the Conference, the chairman put the question, "Can any one who is present present facts against the transportability of cholera?" No person responded.

Between inland countries and in any other than maritime ports that com-

municate with distant ports and places, and with ships and persons which are infected with cholera, all restrictions in the nature of quarantine were declared to be unavailing. The resolutions adopted by the Vienna Conference upon this subject were in substance as follows: —

Resolved — (1.) "That the inland and river quarantine should be abolished.

(2.) "That the sea quarantine should for the present be enforced.

(3.) "That an International Commission should be chosen for the purpose of studying the exotic agent by which cholera is spread, and which, therefore, should be eliminated from every kind of intercourse, so that better measures of protection may be found than those employed heretofore."

All the researches which have hitherto been made concerning the course and causes of epidemic cholera seem to agree in the following sanitary facts: —

(1.) Special and efficient sanitary regulations in all places and thorough methods of cleansing and disinfection are the true safeguards against the visitations of cholera epidemics, and for the commercial countries detentions and quarantines are not generally practicable.

(2.) That to be of any general utility in preventing the diffusion of cholera over the world, the systems of restriction or quarantine would need to be international.

(3.) That the sick and the dead of cholera should be secluded, and that whatever methods of cleansing and disinfection are adopted should be thorough and sufficient, — should secure absolute disinfection, and not merely disinfection in name simply.

At last the habits and the factors in the cause of cholera epidemics are sufficiently well understood to warrant the belief that this pestilential destroyer may be successfully resisted, and its material means of propagation be completely controlled. Medical theories and the hypotheses of naturalists concerning it may differ, be at variance with the facts respecting this epidemic pest, but upon all the points which are essential to the efficiency of sanitary measures the conclusions which are already reached concerning the sources and the preventive means that are now definitely understood are not of a doubtful nature, but are as well known as any of the similar facts in the causation and prevention of any other epidemic disease. We conclude by recapitulating the more essential deductions upon which the official proceedings of sanitary authorities have been based in those cities and towns which have been most effectually protected from cholera, however seriously threatened by it. We may properly regard these as well established

CONCLUSIONS: —

The pestilential cholera of India has, at last, been proved to be amenable to hygienic measures, even in the largest cities and most populous districts of that country. Bombay, Madras, Calcutta, and even the places where Hindoo pilgrims assemble, as well as the encampments and marches of armies in that native home of cholera, are now saved from epidemics of that disease by sanitary regulations. These regulations comprise effectual methods of cleansing and disinfection, the care and proper separation of the sick, and the sanitary care of the dead of cholera; the application of sanitary rules of

public and personal hygiene in the armies, in the movements of pilgrims, and in the encampments, transports, and caravans of Mohammedan devotees *en route* to and from Mecca, seem now to prove adequate to prevent epidemic outbreaks of cholera among those vast assemblages which were, until sanitary care was officially prescribed, the chief carriers of this pestilence throughout southern and western Asia, and thence to the commercial world. All the outbreaks of cholera that have been witnessed since 1865 seem to have been the legitimate consequences of great sanitary neglects. This is believed to be true in Europe, America, and Asia alike.

The course of cholera from the Caspian and Black Sea regions into Russia, Hungary, and the Danubian regions has been largely connected with the water-craft traffic and travelling; and as shown by the best sanitary observers these movements of cholera into and throughout Europe have occurred in such manner as to have been uncontrollable by any practicable system of external or quarantine sanitary measures. But it is in evidence that by means of thoroughly good public health regulations and the general and special means of sanitary care the pestilential spread of cholera has been prevented in all places where such a sanitary government has been found in full operation; and, on the other hand, the absence of such preventive measures has been characterized in every place in which cholera has prevailed in Europe; and it is yet to be shown that this rule has presented any exceptions in the United States during the remarkable epidemic in the Mississippi Valley in the year 1873.

The local conditions associated in the causation of cholera epidemics seem to be indispensably essential factors in the production of their outbreaks and pestilential progress as truly as the germinal exotic factor from India. The verdict of the chief sanitary observers throughout the world has at last become almost unanimous in support of this doctrine. It is conceded that pestilential cholera does not prevail in any country beyond the confines of southern Asia, except in the presence of the germinal factor of the cause which has been more or less recently derived from India, and perpetuated by repropagation; while, on the other hand, it is only in the presence and by the aid of the local conditions of insalubrity that Asiatic cholera can become epidemic and pestilential. Hence the acceptance of the fact that cholera depends upon an exotic germinal factor which requires local and personal conditions of unhealthfulness for its epidemic development, when correctly understood, tends powerfully to incite to diligent efforts by individuals, families, neighborhoods, sanitary authorities, cities, and governments to remove and prevent the local and the general conditions by which the propagation and pestilential spread of cholera is alone made certain or even possible.

General sanitary improvements and good public health regulations, when intelligently directed and applied with the proper degree of scientific exactness and thoroughness, are adequate to repress and prevent epidemics of cholera.

Observations and the closest investigation of all circumstances and records of epidemic cholera wherever it has prevailed, whether in America, Europe, or India, show that it is so emphatically a pestilence of undeniably insalubrious grounds and places and that such places when visited by this malady become foci for the further diffusion of it, that the sanitary duty of reclaiming all such grounds and localities from their unhealthful state and removing the localizing causes of epidemics, and of cholera especially, must be treated as a first rate sanitary duty, which is required of every local public health government, and as an obligation which the State needs to enforce in every portion of its domain in which cholera is most liable to come.

The recent course of cholera throughout the Mississippi Valley has reaffirmed the lessons of all previous epidemics of this disease respecting the supreme importance of pure water supplies in all cities and villages, and of having all wells and water-springs which are used by the people effectually guarded against any possible soakage and contamination from privies and other sources of excremental defilement. It must be concluded that the history of outbreaks of cholera in all parts of the world conspicuously illustrates the reasons for procuring all water-supplies from sources which cannot become defiled by excremental soakage or outflowings in any such way as to be carriers of bowel diseases, — particularly not of cholera or enteric fever.

The impurity of the local atmosphere of a dwelling place, a village, or a particular district, is proved to be a matter of public sanitary concern, and that environed in a polluted atmosphere the palatial homes of wealth and gayety may suffer equally with the tenements of the humblest classes. In the words of the medical officer of the Privy Council of England, "The specific migrating power of cholera, whatever its nature, has the faculty of infecting districts in a manner detrimental to life, only when the atmosphere is fraught with certain products, susceptible, under its influence, of undergoing poisonous transformations. Through the unpolluted atmosphere of cleanly districts it migrates without a blow; that which it can kindle into poison is not there."

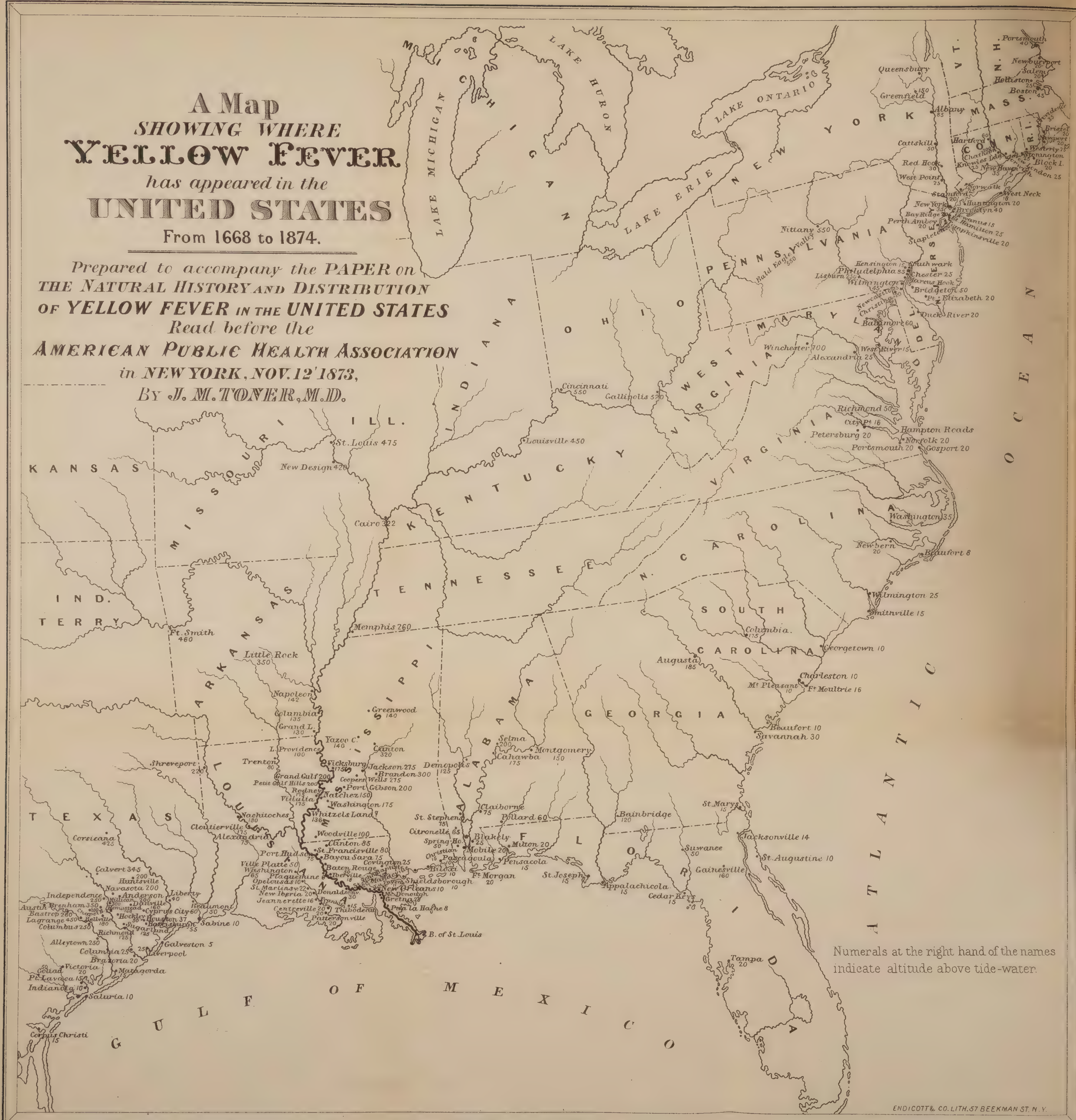
Concerning those Sanitary Regulations which are in the nature of restrictive separation of the sick from the well, and of things — whether personal clothing or ships — which are believed to be infected with and capable of communicating cholera poison, it must be confessed that there are practical difficulties in defining and successfully enforcing the most rational measures, and further, that practically, the greater part of all restriction and quarantine regulations have been too absurdly irrational and untrustworthy to be allowed any share in the defenses against epidemic cholera. This allegation cannot at present apply to the quarantine system of the port of New York nor to the restrictive measures which have from time to time been enforced at the ports of Malta and of Sicily. A large experience and careful study of this subject warrant the conclusion that as respects ports of entry and ports

of departure which are at a particular time liable to have cholera, and the exotic cause of cholera in any manner brought upon vessels or among migrants and passengers, sanitary police regulations and certain rational restrictions in the nature of seclusion, cleansing and disinfection of all such sources of infection or carrying of cholera should be enforced. This is the sanitary system of the port of New York.

The utility of disinfectants as preventives of cholera is predicated (1) upon their power to neutralize and destroy the essential cause of cholera, that is, its infective attribute or poison; (2) upon their colytic or antiseptic effect in preventing putrefaction and in neutralizing the foul products of decay and putrescence. Upon this subject no rational doubt any longer exists. The utility of disinfectants and the relative usefulness of different agents for these purposes are demonstrated facts. But the effectiveness and sanitary value of any or all of the chemical agents employed in disinfection depends upon the exact fitness, the sufficiency and thoroughness, and the timeliness of the application. Much that passes for disinfection and sanitary cleansing are such only in name. In these sanitary acts and duties nothing is more true than that "What is worth doing at all is worth doing well."

The supreme importance of giving perfect sanitary care to the very first cases, and groups of cases of cholera, and of persons suffering from diarrhœal disorders wherever cholera is possible, especially the timely and effectual employment of disinfection in all such cases, the most exacting medical supervision and official watchfulness, under local health government, should be understood and practiced in all places where there is a possibility of an outbreak of cholera.

As a final conclusion upon the whole subject of sanitary defenses against cholera, no truth is more important and none more completely established as a basis for official proceedings than this, namely, that common and thorough sanitary improvements and precautions such as every family, every householder, every village, city, district, and state, should always enforce as general and necessary means of protection and improvement of the public health, are the most essential means of protection against cholera, and the only means which, practically considered, are adequate to prevent the Asiatic cholera from becoming an epidemic and pandemic pestilence again and again; and, finally, that the "stamping out" of pestilential cholera consists in the complete execution of all these common hygienic duties, the intelligent administration of sanitary regulations relating to common cleanliness and to special disinfection, the perfect sanitary care of the sick, the assured purity of water-supplies, and the prevention of excremental pollution of the grounds about dwellings and of the common atmosphere. These are ordinary sanitary duties, and it is by an extraordinary promptness, intelligence, and thoroughness in their application that cholera can be stamped out after it has appeared in a community; but by maintaining such sanitary defenses as means of general improvement of the public health the world over, or in any country or city, pestilential cholera will cease its visitations, and wherever such sanitary defenses exist, this stalking terror of all the continents would be known only in the historical records of the past.


A Map
SHOWING WHERE
YELLOW FEVER
has appeared in the
UNITED STATES
From 1668 to 1874.
Prepared to accompany the PAPER on
THE NATURAL HISTORY AND DISTRIBUTION
OF YELLOW FEVER IN THE UNITED STATES
Read before the
AMERICAN PUBLIC HEALTH ASSOCIATION
in NEW YORK, NOV. 12' 1873,
BY J. M. TONER, M.D.
Numerals at the right hand of the names indicate altitude above tide-water.
ENDICOTT & CO. LITH. 57 BEEKMAN ST. N.Y.
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
GULF OF MEXICO
ATLANTIC OCEAN

V.

REPORTS UPON YELLOW FEVER.

THE DISTRIBUTION AND NATURAL HISTORY OF YELLOW FEVER AS IT HAS OCCURRED AT DIFFERENT TIMES IN THE UNITED STATES.

BY J. M. TONER, M. D.,

President of the American Medical Association, Washington, D. C.

THE map which accompanies this paper, and which indicates the region where yellow fever has appeared and prevailed, either in epidemic form or in sporadic or imported cases since the settlement of our country, is made up from notes taken in the study of the geographical distribution of the diseases of the United States.[1]

No special opportunities for studying the disease in question are claimed, nor originality in the mode of presenting the facts. Nevertheless, the map is believed to be accurate as far as to situation given, if the data derived from our medical literature can be relied upon.

Nor is it pretended that this paper is exhaustive, localities not named having, no doubt, been visited by this fever; but we are confident such will be found within the region of its general distribution, as here indicated.

The table accompanying this paper, which furnishes mainly the data upon which the map is projected, gives the names of the cities and other localities where yellow fever has occurred in our country from its first settlement, arranged by States in alphabetical order, with the years and the day of the month of its appearance and disappearance.

The elevation of each locality above the sea-level, as far as possible, has been given from reliable sources. In some instances the elevation of a place is assumed from a general knowledge of the altitude of the surrounding country. The errors in these, if any, will be unimportant.

The influence of elevation above the sea-level upon localities, and the exemption from yellow fever they seem to apparently possess, is the view we here wish to call to the attention of sanitarists and of the profession.

We are inclined to give much weight to the theory that diseases have geographical areas and limits, modified somewhat by latitude and by topographical features and conditions, which may determine the types of disease as do climate and elevation the fauna and flora of localities.

[1] The map herewith published is projected from a large one, eight by ten feet in size, for the execution of which Dr. Toner desires to express his indebtedness to the kindness of the Hon. Willis Drummond, Commissioner of the United States Land Office.

The fact has always been patent to the profession, that there are parts of the earth in which particular forms of disease occur, to the almost entire exclusion of others. The study of the causes of this difference is as important as any that can engage the attention of the physician. As a simple factor elevation will, we believe, be found to possess qualities preventive of certain diseases and curative of others.

We shall in this paper studiously avoid discussing the questions whether yellow fever is a specific disease or not; whether it is always imported; or whether under certain conditions it may originate within our own country.

Nor do we aim to speak as an expert, never having seen a case of yellow fever, but rather appear as a collator of facts in its history, as observed and recorded by others. At the present time the natural history of diseases, if we may so use the term to designate the special characteristic of the diseases that exist within limited geographical areas, is attracting much attention. There can be no doubt that an accurate knowledge of the climate and other physical peculiarities, with the prevailing meteorological conditions of a region, will greatly aid the sanitarist and physician in preventing sickness, and in treating successfully the diseases incident to the section.

The more exact and extended this information becomes, the more definitely can physicians mark out the boundaries and the distribution of diseases over the globe, and suggest measures of prevention and relief.

The chief factors usually and most naturally taken into account in the study of the salubrity of a state, or even a city, are latitude, longitude, the extremes of heat and cold and mean annual temperature, the prevailing direction and force of the winds, the general humidity of the air, and the annual precipitation, drainage, etc.

These undoubtedly furnish most valuable information, but there is another important element, that of elevation, which has the power to intensify or counteract the influence of most of them.

The most insalubrious regions are, confessedly, the savannas and tidewater lands of the tropic and temperate zones. The impression is quite general that persons of the same nationality, living on mountains or on high table lands are more rugged and healthy, as a general rule, than their friends engaged in similar occupations on the low lands in the same latitude.

The accompanying map enables us, in a comprehensive way, to consider the question whether elevation has presented any barrier to the progress of yellow fever in the United States, by bringing all localities where it has prevailed, with their altitudes, before the eye at one time.

The fact will be patent to any one that the low lands of the Gulf States and the Atlantic coast, with the water-courses emptying into them, are the regions of its most frequent appearance within the United States.

The conceded home of yellow fever is in the West Indies and the Bahamas, with a portion of the adjacent continents of North and South America. A square formed by the forty-fifth and the one hundredth degrees of longitude, and the thirty-fifth north and the fifth south latitude, will include the favorite region of this disease.

Although originating within the square named, history shows that it may prevail on the sea-coast in any locality within the tropics, north and south of the equator, where malarial fevers prevail, and the daily average of the thermometer is over 75° or 80° with a high dew-point for weeks or months together.

If these latter conditions, however, were the only ones necessary to the development of this disease, it should prevail much more widely within the United States than it does ; for they exist, during parts of the summer at least, in almost all of our Atlantic cities, as may be seen by reference to the record of temperature as shown by the admirable isothermal maps in Lorin Blodgett's " Climatology."

There are, no doubt, other causes and climatic conditions essential to its origin, if not to its propagation and spread. Once the disease has become epidemic in a place, it can exist at a much lower average daily range of the thermometer than seems to be required for its development.

It is, however, always controlled in its severity and checked in its spread, or entirely arrested by storms, heavy rains, and, most effectually, by frost. This has been exemplified by the polar waves, or " northers," that occasionally blow from the Arctic regions down over Texas, and by long-continued rains.

Yellow fever does not prevail in the East Indies nor in China. It has appeared in most of the maritime cities of the United States on the Atlantic coast, as far north as Boston, and indeed has been chronicled at Quebec and Halifax. But while it is true that it has thus been carried to many of the cities and towns on the sea-coast, it has, fortunately, never extended far into the interior of our country, or remote from the water highways.

In the United States, it seems to prevail in the large seaports and in localities along the navigable water-courses having their outlet in the Gulf of Mexico. Dr. Drake, many years ago, observed that while the disease had appeared at almost every town on the Mississippi, as far up as Vicksburg, that Woodville, twelve miles from the river, was the most remote inland point it had reached. During the late epidemic at Shreveport, a number of deaths occurred, according to the report of the Howard Association, at points outside the city limits — distances from the city not given. The places named are Caddo Parish, Marshall, Greenwood, and Summer Grove.

The same accurate observer (Dr. Drake) remarks that yellow fever is eminently a disease of cities rather than of rural districts, and of villages rather than of scattered country dwellings. It has also been observed that towns of small population are less liable to suffer than larger ones, and the same town within the yellow fever zone, as its population increases, is more likely to suffer than when its population was less. This is in confirmation of the view that density of population, or proximity of numerous individuals approaching to crowding, is believed to be a factor of no small influence in the propagation and spread of the disease.

Its appearance in a locality is generally coincident with the season of bilious intermittents, and the first cases are said nearly always to occur near the water in the lowest and most insalubrious places.

It has been observed that its epidemical limits coincide very closely with the range or limit of the growth of the live-oak, the cypress, and the long mosses. Certainly the regions of our country most frequented by this disease are particularly low and flat, with numerous rivers and much marsh and swamp lands, as may be inferred from the localities and their elevations above tide water marked on the map. These low lands in the Gulf States are to a considerable extent covered with the cypress, long-leaved pine, and other indigenous trees, or with thick undergrowth when in an unredeemed or natural state. The northern limit of the growth of the cypress is not much if at all north of Norfolk.

Yellow fever has been considered by nearly all writers a distinct disease from the autumnal remittent fevers of the temperate zone. All agree that it is indigenous at Vera Cruz on the Gulf of Mexico. When we examine into the climatic conditions of this locality, nothing special or satisfactory as an explanation of the origin of the disease can be discovered.

Protracted average high temperature is a constant factor there, but this of itself is deemed insufficient. The time has, perhaps, not come for the discovery of all the elements entering into its development.

No doubt there are numerous undiscovered factors and conditions, essential to its existence and present in varying intensity, in different years, and situations which greatly add to its rapid spread and virulence. The mortality from the disease at the same place it is well known is much greater in some seasons than others even when the conditions of heat and moisture are apparently the same. Again, extreme heat and dryness stop the epidemic, as do heavy and protracted rains.

As we have already stated, the conditions of long-continued heat, averaging over 75° throughout the twenty-four hours, and great humidity exist almost constantly during the summer in the Gulf States. Occasionally during the summer season, for months together, this condition of high temperature, but with less moisture, exists in many of the coast cities of our country, as far north as Boston, and yet rarely ever are these cities visited by this disease in an epidemic form.

Is the exemption of these more northern coast cities due alone to the climatic condition of low temperate or are they protected by sanitary and quarantine regulations? Yellow fever is almost annually reported on vessels at the quarantine stations of all our Atlantic seaport cities, where it is fortunately arrested and prevented from entering the cities. In the table of the localities where the disease has prevailed, no distinction has been made between the city proper and the quarantine station, but this, in a more careful study, ought to be observed.

The average annual distribution of moisture in every city and situation throughout our country is made manifest by a glance at Charles A. Schott's "Tables and Results of the Precipitation in Rain and Snow," published in 1872 by the Smithsonian Institution, which is a most valuable contribution to knowledge in this direction. The humidity in the atmosphere is relative to the season, and, as is well known, the absolute humidity is greater in the summer than in the winter, warm air having a greater capacity to con-

tain moisture than cold air, as the following table from Professor Guyot will show. This table expresses, in Troy grains, the weight of vapor contained in a cubic *foot* of *saturated air* at the stated temperatures of Fahrenheit: —

Temperature of Air.	Vapor in Grains.	Temperature of Air.	Vapor in Grains.	Temperature of Air.	Vapor in Grains.
0°	0.545	63°	6.361	80°	10.949
5	0.678	64	6.575	81	11.291
10	0.841	65	6.795	82	11.643
20	1.298	66	7.021	83	12.005
30	1.968	67	7.253	84	12.376
32	2.126	68	7.493	85	12.756
40	2.862	69	7.739	86	13.146
45	3.426	70	7.992	87	13.546
50	4.089	71	8.252	88	13.957
55	4.860	72	8.521	89	14.378
56	5.028	73	8.797	90	14.810
57	5.202	74	9.081	91	15.254
58	5.381	75	9.372	92	15.709
59	5.566	76	9.670	93	16.176
60	5.756	77	9.977	94	16.654
61	5.952	78	10.292	95	17.145
62	6.154	79	10.616	96	17.648

To see how far the conditions of a higher than ordinary average of temperature and a greater degree of humidity may have existed in Memphis and Shreveport during the prevalence of the epidemic of the past summer, we have been enabled, through the courtesy of General Myer, to tabulate the meteorological observations, nearly complete, made for Memphis to the United States Signal Bureau for the months of August, September, October, and November, 1872 and 1873. The former year, being healthy at this place, is included for the purpose of contrast. The meteorological tables for Shreveport were compiled from the observations furnished by Dr. J. L. Moore, of Shreveport, the regular observer for the Smithsonian Institution at that point. In addition to the ordinary observations, Dr. Moore gives the daily number of deaths occurring from yellow fever, which, for convenience, is placed in a parallel column on the side of the meteorological table, and on the line of the other daily observations. For Shreveport we are not able to give the observations in 1872 for contrast.

The tables having already appeared in different publications bearing upon the epidemic in these cities, we omit them here.

The record of the meteorological conditions observed during the period of the prevalence of the epidemic yellow fever at Memphis and Shreveport

in 1873, undoubtedly furnish important facts which are essential to a correct study of the habits and climatic conditions under which this disease exists. Yet we are unable to deduce from them, or to recognize any positive factor or factors not common to other seasons in the same localities that can satisfactorily account for the outbreak and the prevalence, for months, of a specific fever which is very generally believed by physicians to have been imported from New Orleans, where, however, it was not recognized by the Board of Health as being epidemic or even extensively prevalent during any part of the summer.

We may here remark, that in the study of this disease as seen in the United States, we are constantly confronted with evidences which render it possible that it is to man himself, and his neglect of the laws governing health and the sanitary conditions of his abode, that we must look for at least some of the exciting causes or conditions which enable yellow fever even if imported to exist and propagate itself.

That the disease has geographical limits though varying its boundaries during particular seasons, will be readily conceded. One of the limiting causes assigned by most observers, is low temperature. We believe that elevation and a comparatively dry atmosphere also should be added.

We ask the question if, from the facts furnished by the different visitations of yellow fever within the United States, elevation is entitled to be credited in any degree with controlling the spread of the disease to interior towns; and if so, does elevation control it in any other mode than by the effect of a cooler and drier atmosphere than prevails in the low lands in the same vicinity?

Nothing is truer than that man's health is affected by his surroundings. Where a rapid vegetable growth and decay goes on, as in the tropical and semi-tropical regions, such localities must always have conditions peculiar to themselves, which influence powerfully both health and disease, although the particular elements affecting vital actions in man may escape our observation.

Humboldt long ago observed that this fever did not exist at high altitudes. A. Keith Johnson, in his valuable "Physical Atlas," says: "At Xalapa, in Mexico, on the same parallel with Vera Cruz, 4,330 feet above the sea, yellow fever is unknown." In Jamaica, Maroontown and the Phœnix Park, with an elevation of 2,000 feet, are noted for their healthfulness, while yellow fever rages along the coast, cutting off many hundreds annually. In this island, however, it has been known to exist in a mild form on Stony Hill, elevated 1,360 feet.

Major Tullock, of the British army, remarks that this disease has never been known in any climate at an elevation of 2,500 feet. Mount Desmoulin, near Roseau, in the Island of Dominica, 1,500 feet above the sea, is always free from fever, even while it is epidemic at the water-line. The same exemption is observed in the northern and elevated parts of San Domingo, whatever may be the character of the soil.

Dr. Drake, in his work, fixes a limit to this fever in the United States at four hundred feet. These figures would seem to be not far out of the way,

as these studies show. This view of the limitation to the spread of yellow fever by elevation has also been observed in Cuba and elsewhere.

Fort Smith, in Arkansas, 460 feet above the sea, is the highest point at which this fever has prevailed as an epidemic in the United States. Although the disease may be transported to a locality where it will not propagate, as Winchester, Va., at an altitude of 700 feet, is placed upon the map, the cases reported to have occurred there in 1802 are not well authenticated. A correspondence with Dr. G. Miller, an old and intelligent physician of that place, was opened to verify the report, but nothing could be learned that would give credibility to the statement. As a chronicler, however, we do not feel at liberty to omit the mention of the disease at this place, with the authority, and the less so since a person *en route* from the South died there shortly after his arrival, in 1871, of what was supposed to be yellow fever. There is much room for doubt, also, as to the correctness of the diagnosis that recognized yellow fever at Gallipolis, in Ohio, in 1796, and in Bald Eagle Valley and Nittany, in Pennsylvania, in 1799.

The cases at Cincinnati in 1871 and 1873 were strangers, reported to have been brought there on boats from New Orleans and Memphis, which renders it probable that they were yellow fever, but contracted before sailing. No new cases occurred at Cincinnati. Those reported at Winchester, Gallipolis, Bald Eagle Valley, Nittany, and other points, not here questioned, may have been only aggravated cases of bilious fevers.

But lest we be misled, and attribute too much influence to elevation, we should not forget the remark of the late Dr. La Roche, who notices how securely a stranger may live in the near vicinity of the epidemic, provided he does not enter the infected district. This fact suggests that the stratum of air, in which the infection peculiar to yellow fever exists, is heavier than air free from the poison, and therefore seeks the lowest and dampest localities.

If this view should be verified by careful and repeated observations, it would suggest that houses and hospitals, in districts particularly liable to yellow fever, should be built upon columns or supports ten or twelve feet high, with the space beneath paved and left open for the free circulation of air. The occupants might thus, to some extent, escape breathing the heavier and more noxious stratum of air.

It is clear, as shown by this map, that the disease has, in the United States, never reached in an epidemic form an elevation of five hundred feet. If elevation, then, can exempt the inhabitants of a place from such a terribly destructive disease, the profession should, and will, avail itself of this fact among the means of protecting life, namely, the removal of all susceptible persons out of the infected district to a greater elevation and to one above five hundred feet if practicable. So far as we could collect facts and returns bearing upon the point in question as to each locality we have done so, and they are given in the following table : —

Table of Localities in the United States where Yellow Fever has appeared since 1668.

WITH THEIR ELEVATIONS ABOVE THE SEA-LEVEL; DATES OF COMMENCEMENT AND SUSPENSION OF THE DISEASE; MORTALITY; AND AUTHORITIES FOR THE STATEMENTS.

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
Alabama	Blakely, Baldwin Co.	On Tensaw River	25	1822					Drake, Principal Diseases of Interior Valley, North America, p. 225.
	Cahawba, Dallas Co.	On Alabama River	175	1821					Dr. Heustis, p. 369.
				1822					Dr. Heustis, p. 369.
				1853					E. H. Barton, Report Sanitary Commission of New Orleans, 1857, p. 65.
	Citronelle, Mobile Co.	On Mobile and Ohio Railroad	65	1853					J. C. Nott, N. O. M. & S. J., 1854, p. 571.
	Dog River Cotton Factory	Five miles from Mobile	30	1853	Aug. 8				C. Whattleworth, Ch. M. J. & Rev., 1859, p. 479.
	Demopolis, Marengo Co.	On Tombigbee River	125	1853					E. D. Fenner, History of Epidemic Yellow Fever, 1853, p. 49.
	Fort Claiborne, Monroe Co.	Alabama River	75	1819	July 4	1819	Dec. 1		Harvey E. Brown (asst. surg., U. S. A.), Quarantine, on the Southern and Gulf coasts, 1872.
	Fort Morgan Island	Mobile Bay	20	1867	Aug. 13				Brown, Quarantine, p. 44.
	Fort Saint Stephens, Washington Co.	Tombigbee River	75	1819	July 4	1819	Dec. 1		Dowler, Yellow Fever of 1853, p. 16.
	Hollywood	Tombigbee River	75	1853					E. H. Barton, Report Sanitary Commission of New Orleans, 1857, p. 65.
	Mobile, Mobile Co.	Mobile Bay	20	1705					P. H. Lewis, N. O. M. J., 1845, vol 1, No. 4, p. 283.
				1765					Drake, Dis. Int. Valley of N. A., p. 216.
				1766					P. H. Lewis, N. O. M. J., vol. 1, No. 4, 1845, p. 283.
				1819	Aug. 15		Nov. —	274	Ibid, p. 284.
				1821					Drake, Dis. Int. Valley of N. A., p. 191.
				1822					Ibid, p. 191.
				1824					Ibid, p. 191.
				1825	Sept. —				Ibid, p. 219.
				1827	Aug. —				Ibid, p. 219.
				1828					Ibid, p. 191.
				1829	Sept. 14			130	Ibid, p. 220.
				1837	Sept. 20	1837	Nov. —	350	Ibid, p. 220.
				1838					Ibid, p. 191.
				1839	Aug. 11	1839	Oct. 20	650	Drake, and Brown, Quarantine, 1872.
				1841					J. H. Lewis, N. O. M. J., 1844, p. 31.

				1842	Aug. 20	......	....	60	Drake, p. 222, and Brown, Quarantine, 1872.
				1843	Aug. 18	1843	Nov. 5	240	Ibid.
				1844	....	......	....	......	Drake, Diseases Int. Valley of N. A., p. 191.
				1847	....	......	....	76	Brown, Quarantine, and Fenner's South Med. Reports, vol. 2, p. 304.
				1848	....	......	....	75	Fenner, South Med. Reports, vol. 2, p. 304.
				1849	....	......	....	50	Ibid.
				1851	....	......	....	......	Brown, Quarantine, 1872, p. 43.
				1853	July 13	1853	Nov. 1	1,151	N. O. M. and S. J., 1854, p. 571.
				1854	....	......	....	......	Ed. Nash. J. M. and S., 1854, p. 345.
				1855	Sept. —	......	Nov. —	30	R. F. Michel, Charleston Med. Journal and Review, vol. 1, No. 4, 1874, p. 289.
				1858	....	......	....	......	Ed. Va. M. J., 1858, p. 517.
				1867	Aug. 13	......	....	......	Brown, Quarantine, 1872, p. 44.
			162	1873	Sept. 4	......	Nov. 10	102	R. F. Michel, Charleston Med. Journal and Review, vol. 1, No. 4, 1874, p. 289.
	Montgomery, Montgomery Co.	On Alabama River.........		1853	Sept. —	......	Nov. —	35	Ibid., p. 303.
				1854	Sept. —	......	Nov. —	45	Ibid., p. 303.
				1870	Aug. 22	1870	Nov. 19	......	G. A. Ketchum, Trans. A. M. S., 1871, p. 269.
				1873	Aug. 21	1873	Nov. 29	27	O. L. Crampton, Rep. Sup. Surgeon (J. M. Woodworth), U. S. Marine-Hospital Service, 1873.
	Pollard, Escambia Co......	....	60	1873	....	......	....	......	J. Jones, B. M. and S. J., 1873, p. 543.
	Selma, Dallas Co..........	On Alabama River.........	200	1824	....	......	....	......	Dr. Gantt.
				1853	Sept. 17	1853	Nov. 13	32	J. C. Marks, N. O. M. and S. J., 1854, p. 88.
				1854	....	......	....	......	Dr. Harris, pp. 18, 19.
				1855	....	......	....	......	Ibid.
Arkansas.......	Spring Hill, Mobile Co.....	Six miles west of Mobile...	50	1853	....	......	....	......	J. C. Nott, Ch. Med. J. and Rev., 1859, p. 476.
	Columbia, Chicot Co.......	On Mississippi River.......	135	1853	June —	......	....	......	Trans. A. M. A., 1854, p. 526.
	Fort Smith, Sebastian Co...	On Arkansas River.........	460	1823	....	......	....	......	Dowler, Tableau of Yellow Fever, p. 24.
	Grand Lake, Chicot Co.....	On Mississippi River.......	130	1853	....	......	....	......	D. N. Jones, N. O. M. and S. J., 1853, p. 328.
	Little Rock, Pulaski Co....	On Arkansas River.........	350	1873	....	......	....	......	Washington Republican, vol. 13, No. 280, p. 1.
Connecticut.....	Napoleon, Desha Co.......	On Mississippi River.......	142	1853	....	......	....	......	E. D. Fenner, His. Epi. Yel. Fever, 1853, p. 49.
	Chatham, Middlesex Co....	On Connecticut River......	200	1796	Aug. 29	......	....	......	Miner and Tully on Fevers, p. 357.
	Hartford, Hartford Co.....	On Connecticut River......	60	1798	....	......	....	......	Brown, Quarantine, p. 8.
				1800	....	......	....	......	M. Repos., 1800, p. 197.
	Knowles' Landing..........	On Connecticut River......	25	1796	Aug. —	......	....	9	N. Y. M. and Ph J., 1822, p. 153.
	Middletown, Middlesex Co..	On Connecticut River......	40	1820	June —	......	....	......	W. Tully, N. Y. M. and Ph. J., 1822, p. 153.
	New Haven, New Haven Co.	On Connecticut River......	35	1743	....	......	....	......	Daily Shreveport Times, vol. 2, No. 34, 1873.
				1794	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1803	....	......	....	......	Brown, Quarantine, 1872, p. 9.
				1804	....	......	....	......	Ibid., p. 9.
				1805	....	......	....	......	Dowler, Tableau of Yellow Fever, p. 13.
				1819	....	......	....	......	F. Pascalis, M. Repos., 1820, p. 239.
	New London, New London Co.	On Thames River, three miles from ocean.	25	1798	Aug. 26	......	Nov. —	81	Ed. M. Repos., 1799, p. 211.
	Norwalk, Fairfield Co......	On Norwalk River.........	25	1798	....	......	....	......	J. Gotham, Jr., M. Reporter, 1856, p. 563.
	Stamford, Fairfield Co.....	On Long Island Sound.....	20	1745	....	......	....	......	
	Stonington, New London Co.....................	On Long Island Sound.....	20	1798	....	......	....	......	J. Comstock, M. Repos., 1807, p. 23.
Delaware.......	Christiana, Newcastle Co...	On Christiana Creek........	20	1798	....	......	....	......	J. Vaughan, Med. Repos., 1800, p. 372.
	Duck Creek, Newcastle Co.	Near Delaware Bay..	20	1798	....	......	....	......	J. Stephens, Med. Mus., 1809, p. 153.
	Newcastle, Newcastle Co...	On Delaware River.........	25	1798	....	......	....	......	Ibid.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
Delaware	Wilmington, Newcastle Co.	On Christiana Creek, 2 miles from Delaware River.	45	1798				250	J. Stephens, Med. Mus., 1809, p. 153.
				1802				86	Med. Repos., 1803, p. 235.
Florida	Apalachicola, Franklin Co.	On Apalachicola Bay	15	1826					Drake, Diseases Int. Valley, N. A.
	Cedar Keys, Levy Co.	Isles of the Ocean	15	1871					Brown, Quarantine, p. 42.
	Gainesville, Alachua Co.		160	1871	Aug. —				Ibid.
	Jacksonville, Duval Co.	On Saint John's River	14	1857					F. M Robertson, Ch. M. J. and Rev., 1858, p. 45.
	Key West, Monroe Co.	On an island in the sea	15	1824					B. Ticknor, N. A. M. and S. J., 1827, p. 213.
				1829					C. C. Dupré, Am. J. of Med. Sci., 1841, p. 380.
				1841	June —			26	Ibid., p. 380.
				1853	Aug. —		Aug. —	112	Army Medical Statistics, p. 323.
				1854		1854			Ed. N. O. M. & S. J., 1854, p. 423.
				1862	June 20		Oct. —	71	Ed. M. and S. Reporter, 1862, p. 513.
				1864					E. B. Hunt, Med. Reporter, 1864, p. 340.
				1865					Brown, Quarantine, p. 40.
				1867					Surgeon Gen.'s Office, Circular No. 1, 1868, p. 152.
				1869					Brown, Quarantine, p. 41.
	Milton, Santa Rosa Co.	On Blackwater River, near Pensacola Bay.	20	1853					Ibid., p. 38.
				1855					Ibid,, p. 38.
	Pensacola, Escambia Co.	On Pensacola Bay	15	1764					P. S. Townsend, N. Y. M. and Ph. J., 1823, p. 315.
				1765				125	Drake, Dis. Int. Valley of N. A., p. 190.
				1811					Ibid., p. 190.
				1822	Aug. 12		Oct. 10	257	Ibid., p. 229.
				1825					Brown, Quarantine, p. 36.
				1827					Med. Statistics, United States Army, p. 58.
				1834	Aug. 23				Drake, Dis. Int. Valley of N. A., p. 232.
				1839					Ibid., p. 233.
				1841					Ibid., p. 233.
				1842					S. C. Lauræson, Maryland M. & S. J., 1843, p. 393.
				1843					Dr. Wedderburn, Report of San. Com., p. 125.
				1844					Ibid., p. 125.
				1845					Brown, Quarantine, p. 36.
				1846					Ibid., p. 36.
				1847					Dr. Wedderburn, Report of San. Com., p. 125.
				1848					Ibid., p. 125.
				1853	July 9				E. D. Fenner, History Yellow Fever, N. O., 1853, p. 49.
				1854					R. B. S. Hargis, N. O. M. N., 1859, p. 727.

				1858					Ibid., p. 727.
				1863	Aug. 25				B. F. Gibbs, A. J. M. Sc., 1866, p. 340.
				1867	July 24			34	M. Reporter, 1868, p. 227.
				1873	Aug. 6			61	R. F. Michel, Charleston M. J. and R., 1874, vol. 1, No. 4, p. 289.
	St. Augustine, St John's Co.	On Matanzas Sound, two miles from the sea.	10	1807					Brown, Quarantine, p. 32.
				1821	Aug. —			140	J. Gotham, M. Reporter, 1856, p. 564.
				1838					C. C. Dupré, A. J. Med. Sci., 1841, p. 384.
				1839	Aug. 15				Ibid., p. 384.
				1841				26	Ibid., p. 384.
	Saint Joseph's, Calhoun Co.	On Saint Joseph's Bay, near Gulf of Mexico.	15	1841					B. M. and S. J., 1841, p. 17.
	Suwanee, Columbia Co.	On Suwanee River	50	1836					T. Lawson, Surg. Gen. Report, 1840, p. 308.
	Tampa, Hillsborough Co.	Head of Tampa Bay, forty miles from the Gulf of Mexico.	20	1839					Drake, Dis. Int. Valley of N. A., p. 191.
				1853	Sept. —				Army Med. Statistics, p. 323.
				1871					Med. and Surg. Reporter, No. 17, p. 377, vol. 25.
	Tortugas	Gulf of Mexico	12	1862				4	Circular No. 1, Surgeon General's Office, 1869.
				1867	July 4			38	Brown, Quarantine, p. 46.
	Pensacola	Pensacola Bay		1873	Aug. 14		Nov. 19	62	John M. Woodworth, Supervising Surgeon, U. S. Marine Hospital Service, Report 1873.
Georgia	Augusta, Richmond Co.	On Savannah River	185	1839					B. M. and S. J., 1839, p. 86.
				1854					Ed. Nash, J. M. and S., 1854, p. 345.
	Bainbridge, Decatur Co.	On Flint River	120	1873					Washington Republican, Oct. 25, 1873, p. 1.
	Columbus			1854				3	J. E. Bacon.
				1867					
	Saint Mary's, Camden Co.	On Saint Mary's River, nine miles from the sea.	15	1808	Sept. 5		Oct. —	84	J. Seagrove, M. Rep., 1810, p. 135.
	Savannah, Chatham Co.	On Savannah River, eighteen miles from its mouth.	30	1807					Dowler, Tableau of Yellow Fever, p. 14.
				1808					Ibid., p. 14.
				1819					A. M. Rec., 1820, p. 212.
				1820					N. A. M., and S. J., 1827, p. 1.
				1827					N. A. Med. and S. J., vol. 10, p. 145.
				1852				19	R. C. Mackall, Ch. M. J. and Rev., 1855, p. 150.
				1853					Ibid., p. 150.
				1854	Aug. 5			580	Hume, Charleston M. J., vol. 10, p. 31.
				1858					S. Chaillé, Va., M. J., 1858, p. 491.
Illinois	Cairo	At junction of Ohio and Mississippi Rivers.	322	1873	Sept. 1		Sept. 25	17	H. Wardner, Report Supervising Surgeon U. S. Marine Hospital Service, 1873.
Kentucky	Louisville	On the Ohio River	450	1873	Sept. 22		Oct. 15	5	P. H. Bailhache, Ibid.
Louisiana	Alexandria, Rapides Parish	On Red River	75	1819					G. S. D. Anderson, N. O. M. J., 1859, p. 508.
				1822					Ibid.
				1827					Ibid.
				1831					Ibid.
				1837					Ibid.
				1839					Ibid
				1847					Ibid.
				1853					Ibid.
				1854					Ibid.
				1855	Sept. 13				Ibid.
	Algiers	On Mississippi River, opposite New Orleans.	10	1847					E. D. Fenner, N. O. M. and S. J., 1848, p. 192.
				1853					P. C. Gaillard, Ch. M. J. and Rev., 1859, p. 481.
				1858					N. O. M. J., 1859, p. 506.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement. Year.	Date of Commencement. Month.	Date of Suspension. Year.	Date of Suspension. Month.	Mortality.	Authority.
Louisiana	Ascension	On Mississippi River	25	1823					
	Baton Rouge	On Mississippi River	50	1817					Drake, Dis. Int. Valley of N. A., p. 250.
				1819					Ibid., p. 250.
				1822				60	Ibid., p. 250
				1827					Ibid., p. 191.
				1829					Ibid., p. 191.
				1837					Brown, Quarantine, p. 48.
				1843	Oct. —				Drake, Dis. Int. Valley of N. A., p. 251.
				1847					N. O. M. and S. J., 1848, p. 536.
				1858					S. Chaillé, Va., M. J., 1858, p. 491.
	Bay of Saint Louis	Mouth of the Mississippi River.	10	1820	Aug. —				A. P. Merrill, N. O. M. and S. J., 1851, p. 1.
				1830					N. O. M. and S. J., 1850, p. 79.
				1853					
	Bayou Sara, West Feliciana Parish.	On Mississippi River	75	1847					E. D. Fenner, N. O. M. and S. J., 1848, p. 19.
				1853					P. C. Gaillard, Ch. M. J. and Rev., 1859, p. 481.
	Burat Settlement (coast below New Orleans).	On Mississippi River	10	1854	Sept. 22				D. R. Fox, Yellow Fever in Country, p. 49.
	Carrollton, Jefferson Parish	On Mississippi River	15	1847					E. D. Fenner, N. O. M. and S. J., 1848, p. 192.
				1855	May 18			1	D. Warren Brickell, N. O. M. N., 1855, p. 167.
	Centreville, Saint Mary's Parish.	On Teche River, 60 miles from the Gulf of Mexico.	20	1853	Sept. 18		Nov. 18		W. B. Wood, N. O. M. N., 1856, p. 483.
				1855	Sept. —		Oct. —	1	Ibid., p. 483.
	Clinton, East Feliciana Parish.	32 miles N. of Baton Rouge.	85	1853	Sept. 1		Dec. —	75	B. Dowler, Tableau of Yellow Fever, 1853, p. 28.
	Cloutierville, Natchitoches Parish.	On Old River, branch of Red River.	175	1853	Aug. 14		Dec. 14		S. O. Scruggs, Trans. A. M. A., 1856, p. 704.
				1854					Ibid., p. 704.
	Covington, Saint Tammany Parish.	45 miles north of New Orleans.	25	1847					E. D. Fenner, N. O. M. and S. J., 1848, p. 192.
	Donaldsonville, Ascension Parish.	On Mississippi River	30	1827					
				1839				30	Drake, Dis. Int. Valley of N. A., p. 247.
	Franklin, Saint Mary's Parish.	On Teche River, 65 miles from the Gulf of Mexico.	15	1853	Oct. 19		Nov. 24	2	J. W. Lyman, N. O. M. and S. J., 1854, p. 670.
				1854					W. B. Wood, N. O. M. N., 1856, p. 483.
	Gretna			1858					N O. M. J., 1859, p. 506.
	Iberville, Iberville Parish	On Mississippi River	28						
	Jeannerrett's, Parish of Saint Mary.		15	1854	Oct. 7				J. B. Dungan, Trans. A. M. A., 1856, p. 697.
	Jesuit's Bend	Settlement on coast below New Orleans.	10	1854	Sept. 12				D. R. Fox, Yellow Fever in Country, p. 49.

Louisiana	La Fayette	Near New Orleans	12	1847	June 22				N. O. M. and S. J., 1848, p. 536.
	Lake Providence, Carroll Parish.	On Mississippi River	100	1853					J. L. Ridell, N. O. M. and S. J., 1854, p. 813.
	Mandeville, Saint Tammany Parish.	On Lake Pontchartrain	15	1847					E. D. Fenner, N. O. M. and S. J., p. 192.
	McDonoughville			1858					N. O. M. J., 1859, p. 506.
	Natchitoches	On Red River	180	1839					Drake, Dis. Int. Valley of N. A., p. 191.
	New Iberia, Saint Martin's Parish.	Southern part of Louisiana	20	1839					Ibid., p. 241.
				1867					Report New Orleans Board of Health, 1872, p. 68.
				1870					Brown, Quarantine, p. 58.
	New Orleans	On Mississippi River	10	1769					S. Chaillé, Va. M. J., 1858, p. 498.
				1791					Ibid.
				1793					Trans. A. M. A., vol. 2, p. 684.
				1794					Stethoscope, vol. 3, No. 11, 1853, p. 665.
				1795					Ibid.
				1796					Ibid.
				1797					Ibid.
				1799					S. Chaillé, Va. M. J., 1858, p. 498.
				1800					Ibid.
				1801					Ibid.
				1802					Dowler, Tableau of Yellow Fever, 1853, p. 12.
				1804					Chaillé, Va. M. J., 1858, p. 498.
				1809					Ibid.
				1811					Ibid.
				1812					Ibid.
				1817	June 18		Dec. —	800	S. Chaillé, Va. Med. J., 1858, p. 498.
				1818				115	M. M. Dowler, N. O. M. N., 1859, p. 308.
				1819	July 1			2,190	S. Chaillé, Va. Med. J., 1858, p. 498.
				1820	July —				Ibid.
				1822	Sept. 1			239	Trans. A. M. A., 1851, p. 207, and Drake, p. 197.
				1823	Aug. 23			1	Ibid.
				1824	Aug. 4			108	Ibid.
				1825	June 23			49	Ibid.
				1826	May 18			5	Ibid.
				1827	July 19			109	Ibid.
				1828	June 18			130	Ibid.
				1829	May 23			215	Ibid.
				1830	July 15			117	Ibid.
				1831	June 9			2	Ibid.
				1832	Aug. 15			18	Ibid.
				1833	July 12			210	Ibid.
				1834	Aug. 28			95	Ibid.
				1835	Aug. 23			284	Ibid.
				1836	Aug. 24			5	Ibid.
				1837	July 24			442	Ibid.
				1838	Aug. 25			17	Ibid.
				1839	July 23			452	Ibid.
				1840	July 25			3	Ibid.
				1841	July 27			594	Ibid.
				1842	July 30			211	Ibid.
				1843	July 5			487	Ibid.
				1844	July —		Sept. —	148	Ibid.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
Louisiana......	New Orleans..............	On Mississippi River.......	10	1845	....	......	....	2	Chaillé, Va. Med. J., 1856, p. 499.
				1846	Aug. —	......	Oct. —	160	Ibid.
				1847	Aug. —	......	Dec. —	2,259	Ibid.
				1848	June —	......	Nov. —	850	Ibid.
				1849	Aug. —	......	Dec. —	737	Ibid.
				1850	July —	......	Oct. —	102	Ibid.
				1851	....	......	....	16	Ibid.
				1852	July —	......	Dec. —	415	Ibid.
				1853	May —	......	Dec. —	7,970	Ibid.
				1854	July —	......	Dec. —	2,423	Ibid.
				1855	June —	......	Dec. —	2,670	Ibid.
				1856	Aug. —	......	Nov. —	74	Ibid.
				1857	June —	......	Dec. —	199	Ibid.
				1858	June —	......	Oct. 10	3,889	Ed. Med. Rep., 1858, vol. 1, No. 4, p. 72
				1862	....	......	....	......	Fenner, S. J. of M. S., May, 1866.
				1863	....	......	....	......	Chaillé, p. 8.
				1864	....	......	....	......	Harris, Sanitary Commission, pp. 251, 266.
				1867	June 10	......	Dec. 22	3,093	Ed. N. O. M. J., 1868, p. 194.
				1870	May 16	......	Dec. —	587	J. C. Fuget, N. O. M. and S. J., vol. 1, No. 2, 1873.
				1871	Aug. 4	......	Oct. —	55	Report N. O. Board of Health, 1871.
				1872	Aug. 28	......	Nov. 30	40	Ibid., 1872, p. 17.
				1873	July 4	......	Nov. 18	225	Orsamus Smith, Report Supervising Surgeon, U. S. Marine Hospital Service, 1873.
	New Orleans (small settlement on coast below).	On Mississippi River.......	10	1854	....	......	....	......	D. R. Fox, N. O. M. N., 1855, p. 409.
				1855	....	......	....	......	Ibid.
	Opelousas, Saint Landry Parish.	Seven miles from the head of navigation on the Courtableau Bayou.	60	1829	....	......	....	......	Carpenter, Sketches, p. 26.
				1837	Oct. 20	......	Nov. —	......	T. A. Cooke, N. O. M. J., 1846, p. 27; Drake, p. 243.
				1839	Aug. —	......	Nov. —	......	Ibid.
				1842	....	......	....	......	Ibid.
				1853	....	......	....	......	T. A. Cooke, South Med. Rec., vol. 34, 1873, No. 4, p. 199.
				1867	....	......	....	......	Ibid.
	Pattersonville, Saint Mary's Parish.	On Teche River...........	20	1853	Aug. 8	......	Dec. —	45	J. S. Grant, M. D., Report San. Com., 1853, p. 43.
				1854	Sept. —	......	....	......	W. B. Wood, N. O. M. N., 1856, p. 483.
				1855	Sept. —	......	....	......	Ibid.
	Plaquemine................	On Mississippi River.......	6	1837	....	......	....	......	Drake, Dis. Int. Valley, N. A., p. 191

Louisiana				1839					Ibid.
				1847					N. O. M. and S. J., 1848, p. 536.
				1853	Sept. —		Oct. —		J. B. Hacker, N. O. M. and S. J. 1854, p. 668.
				1858					S. Chaillé, Va. M. J., 1858, p. 491.
	Point a la Hache, coast below New Orleans.	On Mississippi River	8	1854	Oct. —				D. R. Fox, Yellow Fever in Country, p. 49.
	Port Barre			1870					T. A. Cooke, South Med. Rec., vol. 3, 1873, No. 4, p. 193.
	Port Hudson, East Feliciana Parish.	On Mississippi River	75	1839					Drake, Dis. Int. Valley of N. A., p. 191.
				1841	Oct. 13				Ibid., p. 252.
				1843					Ibid., p. 252.
	Saint Francisville	On Mississippi River	80	1811					Ibid., p. 253.
	West Feliciana Parish			1817					Ibid., p. 253.
				1819					Ibid., p. 253.
				1823					Ibid., p. 253.
				1827					Ibid., p. 253.
				1829	Sept. 22				Ibid., p. 253.
				1839	Aug. 28				Ibid., p. 253.
				1843	Aug. 28				Ibid., p. 253.
				1839				1	P. B. McKelvey, N. O. M. and S. J., 1849, p. 64.
				1843					Ibid.
				1846				1	Ibid.
				1848				1	Ibid.
				1853					B. Dowler, Tableau of Yellow Fever, 1853, p. 26.
	Saint John Baptiste	On Mississippi River	20	1853					C. Delery, N. O. M. and S. J., 1853, p. 405.
	Saint Martinsville, Saint Martin's Parish.	On Teche River	22	1839					Drake, Dis. Int. Valley of N. A., p. 191.
	Saint Mary's Parish (Judge Baker's plantation).	On the Gulf of Mexico	15	1854	Sept. —		Oct. —		C. R. Fassitt, Trans. A. M. A., 1856, p. 662.
	Shreveport, Caddo Parish	On Red River	220	1853	Sept. —		Dec. —		B. Dowler, Tableau of Yellow Fever, 1853, p. 26.
				1873	Aug. 12		Nov. 10	759	John M. Woodworth, Supervising Surgeon U. S. M. H. S., Report 1873.
	Thibodeaux, La Fourche, interior parish.	On Bayou la Fourche	15	1853				160	B. Dowler, Tableau of Yellow Fever, 1853, p. 26.
				1854	Sept. 12		Oct. —		M. A. McLeod, N. O. M. N., 1855, p. 454.
				1846	Sept. 20		Oct. —		W. A. Booth, N. O. M. and S. J., 1849, p. 65.
	Trenton, Washita Parish	On Washita River	80	1853					T. P. Richardson, Report San. Com., p. 42.
	Trinity, Catahoula Parish		175	1865	Aug. —		Oct. —		A. R. Kilpatrick.
	Vidalia, Concordia Parish	On Mississippi River	175	1853	Aug. —				H. B. Shaw, Report San. Com., p. 57.
	Ville Platte, Saint Landry Parish.	On Teche Bayou	50	1870					T. A. Cooke, South Med. Rec., vol. 3, No. 4, p. 197.
	Washington, Saint Landry Parish.	Head of navigation on the Courtableau Bayou.	65	1837					Ibid., p. 199.
				1839					Ibid., p. 199.
				1852					Ibid., p. 199.
				1853	Aug. 15				T. A. Cooke, N. O. M. and S. J., 1854, p. 602.
				1854					T. A. Cooke, South Med. Rec., vol. 3, No. 4, p. 196.
				1867					Ibid.
Maryland	Baltimore, Baltimore Co.	On Patapsco River	60	1794					Dr. Drysdale, Med. Mus., vol. 1, 1805, p. 243.
				1795					
				1797	Aug. —		Nov. —		J. H. Griscom, Visitations of Yellow Fever, p. 8.
				1798					W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1799					Ibid.
				1800					Ibid.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.*—(*Continued.*)

State.	Locality.	Situation.	Elevation, in feet above sea level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
Maryland	Baltimore, Baltimore Co.	On Patapsco River	60	1801					W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1802					M. Reps., 1803, p. 100.
				1805					J. H. Griscom, Visitations of Yellow Fever, p. 13.
				1819	July 21		Oct. 30		D. M. Reese, Yellow Fever, 1819, p. 27.
				1820					H. G. Jameson, A. J. M. C., 1856, p. 372.
				1821					Ibid.
				1822					Ibid.
				1868					Brown, Quarantine, p. 14.
	West River (near Annapolis), Anne Arundel Co.	Near Chesapeake Bay	15						Stewart, Med. Mus., 1805, p. 362.
Massachusetts	Boston, Suffolk Co.	Head of Massachusetts Bay.	45	1691					B. Dowler, Tableau of Yellow Fever, 1853, p. 7.
				1693					Ed. N. Y. J. M., 1856, p. 278.
				1795					B. Dowler, Tableau of Yellow Fever, 1853, p. 7.
				1796	Aug. —				J. H. Griscom, N. Y. J. M., 1856, p. 369.
				1798				200	Ibid.
				1800					S. Emlen, N. A. M. and S. J., 1828, p. 321.
				1802				60	J. Gotham, Med. Rep., 1856, p. 563.
				1805					J. H. Griscom, Visitations of Yellow Fever, p. 13.
				1819					S. Emlen, N. A. M. and S. J., 1828, p. 321.
				1858					F. E. Oliver, B. M. and S. J., 1858, p. 140.
	Holliston, Middlesex Co.	Inland, 25 miles from Boston	75	1741				15	
	Nantucket, Nantucket Co.	On an island in the ocean	20	1763				259	Med. Rep., 1853, p. 107.
	New Bedford, Bristol Co.	On Buzzard's Bay	25	1800					Brown, Quarantine, p. 9.
				1801					B. Dowler, Tableau of Yellow Fever, 1853, p. 11.
	Newburyport, Essex Co.	On Merrimac River	20	1796					J. H. Griscom, N. Y. J. M., 1856, p. 369.
	Salem, Essex Co.	On an inlet of the sea	20	1798					J. Gotham, Jr., Med. Rep., 1856, p. 563.
Mississippi	Biloxi, Harrison Co.	On Biloxi Bay	10	1702					Drake, Dis. Int. Valley of N. A., p. 191.
				1839					Ibid.
				1847					E. D. Fenner, N. O. M. and S. J., 1848, p. 192.
				1853					J. C. Nott, N. O. M. and S. J., 1854, p. 571.
				1858					S. Chaillé, Va. M. J., 1858, p. 491.
	Brandon, Rankin Co.	Inland, 12 miles from Jackson, on branch of Pearl River.	300	1853	Sept. 15				Report Sanitary Commission, 1853, p. 77.
				1854	Sept. 23		Nov. 18		
	Canton, Madison Co.	Inland, 25 miles from Jackson near branch of Pearl River.	320	1855					Trans. A. M. A., 22, p. 201.
	Clifton, Jefferson Co.		175	1853	Aug. 28		Oct. —		A. P. Jones, N. O. M. N., 1856, p. 182.

Mississippi	Cooper's Wells, Hinds Co.	Ten miles from Pearl River.	275	1855	Aug. 23			13	J. S. Beazley, N. O. M. N., 1856, p. 151.
	Grand Gulf, Claiborne Co.	On Mississippi River	200	1853					E. McAllister, N. O. M. and S. J., 1854, p. 675.
	Greenwood, Carroll Co.	On Yazoo River	140	1853				9	Trans. A. M. A., 1854, p. 525.
	Jackson, Hinds Co.	On Pearl River	275	1853					S. C. Farras, Stethoscope, 1855, p. 584.
				1854					Ibid.
	Natchez, Adams Co.	On Mississippi River	150	1817	Sept. —		Nov. 9	9	Drake, Dis. Int. Valley of N. A., p. 263.
				1819	Sept. —		Dec. —	180	Brown, Quarantine, p. 59.
				1823	Aug. 10		Oct. 18	312	H. Tooley, History Yellow Fever, 1823, p. 25.
				1825	Aug. 20		Nov. 1	150	Drake, Dis. Int. Valley of N. A., p. 269.
				1827					A. P. Merrill, Galv. M. J., 1867, p. 861.
				1829	Sept. 1		Nov. —	90	Drake, Dis. Int. Valley of N. A., p. 191.
				1837	Sept. 8		Nov. 25	280	Ibid.
				1839	Sept. —		Nov. —	235	Ibid.
				1844					Cartwright, N. O. M. and S. J., 1848, p. 225.
				1848	June —		Nov. —		C. H. Stine, N. O. M. and S. J., 1849, p. 549.
				1853	July 17				B. Dowler, Tableau of Yellow Fever, 1853, p. 26.
				1855					B. M. and S. J., 1855, p. 275.
				1858					S. Chaillé, Va. M. J., 1858, p. 491.
	Pascagoula, Jackson Co.	On Pascagoula Bay	10	1847					E. D. Fenner, N. O. M. and S. J., 1868, p. 192.
				1853					J. C. Nott, N. O. M. and S. J., 1854, p. 571.
	Pass Christian, Harrison Co.	Near Saint Louis Bay	15	1847					E. D. Fenner, N. O. M. and S. J., 1868, p. 192.
				1853					J. C. Nott, N. O. M. and S. J., 1854, p. 571.
				1855					W. H. Calvert, N. O. M. and S. J., 1856, p. 80.
				1858					S. Chaillé, Va. M. J., 1858, p. 491.
	Petit Gulf Hills, Jefferson Co.	On Mississippi River	200	1853					A. P. Jones, N. O. M. N., 1854, p. 180.
	Port Gibson, Claiborne Co.	On Bayou Pierre	200	1853					E. McAllister, N. O. M. and S. J., 1854, p. 676.
	Rodney, Jefferson Co.	On Mississippi River	175	1829					A. P. Jones, N. O. M. N., 1854, p. 180.
				1843	Sept. 6				C. B. New, West Lane, 1844, p. 301.
				1847					A. P. Jones, N. O. M. N., 1854, p. 180.
				1853					Ibid.
	Shieldsborough, Hancock Co.	On Saint Louis Bay	10	1820	Aug. 20				Drake, Dis. Int. Valley of N. A., p. 214.
				1829	Aug. 5				Ibid.
				1839					Ibid.
	Vicksburg, Warren Co.	On Mississippi River	175	1839					Ibid., p. 191.
				1841	Sept. —		Oct. —		A. L. C. Magruder, N. O. M. J., 1848, p. 689.
				1847					Ed. West Lancet, 1853, p. 575.
				1858					S. Chaillé, Va. M. J., 1858, p. 49.
				1871					Med. and Surg. Rep., vol. 25, No. 16, p. 354.
	Washington, Adams Co.	Inland, near Natchez	175	1825	Aug. —		Nov. —	52	J. W. Monnett, A. J. M. Sc., 1827, p. 243.
	Whitzell's Landing	Twenty miles below Natchez.	135	1817					Drake, Diseases of the Interior Valley of North America, p. 190.
	Woodville, Wilkinson Co.	Fifteen miles east of the Mississippi River.	100	1844					J. W. H. West, Lancet, 1844, p. 347.
				1852					P. C. Gaillard, Ch. M. J. and Rev., 1859, p. 480.
				1853	Aug. 9				A. C. Holt, N. O. M. N., 1856, p. 194.
				1855	Sept. —				Ibid.
				1858					S. Chaillé, Va. M. J., p. 491.
	Yazoo City, Yazoo Co.	On Yazoo River	140	1853	Sept. 1				Trans. A. M. A., 1854, p. 525.
Missouri	Saint Louis, Saint Louis Co.	On Mississippi River	475	1854					Ed. Nash. J. M. and S., 1854, p. 345.
				1855	Aug. 14				W. Webb, N. O. M. N., 1856, p. 52.
	New Design, Saint Louis Co.	Twenty miles below Saint Louis.	420	1797				57	Dr. Watkins, M. Repos., 1801, p. 74.

Table of Localities in the United States where Yellow Fever has appeared since 1668.—(*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
New Hampshire.	Portsmouth, Rockingham Co.	On Piscataqua River, three miles from the ocean.	40	1798	Aug. —	......	Oct. —	100	Med. Repos., 1799, p. 211.
New Jersey.....	Bridgeton, Cumberland Co.	On Cohansey Creek, twenty miles from Delaware Bay.	50	1798	....	......	....	......	J. H. Griscom, Visitations of Yellow Fever, p. 9.
	Gloucester City, Camden Co.	On Delaware River.........	20	1805	....	......	....	......	
	Perth Amboy, Middlesex Co.	On Raritan Bay............	20	1811	....	......	....	5	J. Gotham, M. Rep., 1856, p. 564.
	Port Elizabeth, Cumber. Co.	On Maurice River..........	20	1798	Aug. 9	......	Sept. —	6	G. Lee, M. Repos., 1800, p. 246.
	Woodbury.................	....	......	1798	....	......	....	......	J. H. Griscom, Visitations of Yellow Fever, p. 9.
New York......	Albany....................	On Hudson River..........	85	1746	Aug. —	......	....	45	Ibid., p. 4.
				1798	....	......	....	......	J. Gotham, Jr., M. Rep., 1856, p. 563.
	Bay Ridge, Long Island....	In New York Harbor, 18 miles from ocean.	20	1856	July 13	......	....	......	C. D. Griswold, B. M. and S. J., 1858, p. 214, and E. Harris, Rep. of Yellow Fever Epidemic, pp. 27-60.
	Brooklyn, King's Co........	A Port, 18 miles from ocean.	40	1809	July —	......	Sept. —	40	Gillespie, Amer. Med. and Philo. Reg., vol. 3, p. 101; Ed. N. Y. J. M., 1856, p. 278.
				1823	....	......	....	......	Carpenter, Sketches of Yellow Fever.
				1856	July 14	......	....	......	3d National Quarantine and San. Convention, p. 41.
	Catskill, Greene Co........	On Hudson River..........	50	1743	....	......	....	......	
				1794	....	......	....	......	
				1803	Aug. 10	......	Sept. 28	8	B. W. Dwight, M. Reps.
	Governor's Island..........	New York Harbor.........	25	1856	July 29	......	....	......	3d National Quarantine and San. Convention, p. 41.
				1870	Sept. —	......	Oct. 26	49	Report Board of Health, New York, 1870, p. 29.
	Gowanus, King's Co.......	On Gowanus Cove, near New York Harbor.	15	1856	....	......	....	......	Va. M. J., 1856, p. 328.
	Greenfield, Saratoga Co.....	Far inland.................	150	1798	....	......	....	......	J. G. Scott, M. Repos., 1807, p. 291.
	Huntington, Suffolk Co.....	Huntington Bay............	20	1795	....	......	....	......	Dr. D. Hosack, M. and Philos. Reg., 1813, p. 191.
				1798	....	......	....	......	Ibid.
	New York, New York Co...	A Port, 18 miles from ocean.	35	1668	....	......	....	......	J. H. Griscom, M. Rep., 1856, p. 561.
				1702	....	......	Sept. 30	570	J. H. Griscom, Visitations of Yellow Fever, p. 2.
				1732	....	......	....	......	Ibid., p. 3.
				1741	....	......	....	......	Ed. N. Y. J. M., 1856, p. 278.
				1742	....	......	....	......	Ibid.
				1743	....	......	....	217	J. H. Griscom, Visitations of Yellow Fever, p. 3.
				1745	....	......	....	......	Ibid.
				1747	....	......	....	......	Ibid., p. 4.
				1748	....	......	....	......	Daily Shreveport Times, vol. 2, No. 811, 1873.
				1762	....	......	....	......	Ibid.

New York....	New York Co....	....	....	1790	....	....	....	....	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1791	Aug. —	....	Oct. 15	....	Ed. N. Y. J. M., 1856, p. 278, and Brown, Quarantine, p. 6.
				1792	....	....	....	....	Ed. N. Y. J. M., 1856, p. 278.
				1793	....	....	....	....	Ibid.
				1794	....	....	....	....	Ibid.
				1795	July 19	....	....	730	Bayley's Account of Epidemic Fever, 1795.
				1796	....	....	....	....	Ed. N. Y. J. M.. 1856, p. 278.
				1797	....	....	....	....	Ibid.
				1798	Aug. —	....	Nov. —	2,080	Ibid.
				1799	July —	....	Nov. —	76	Ibid.
				1800	Sept. —	....	Oct. 14	*21	Ibid.
				1801	Sept. —	....	Oct. —	*16	Ibid.
				1802	....	....	....	*2	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1803	July 18	....	Oct. —	6–700	Ed. N. Y. J. M., 1856, p. 278.
				1805	June —	....	Oct. —	340	J. H. Griscom, M. Rep., 1856, p. 561.
				1806	June —	....	Nov. —	*0	Ed. N. Y. J. M., p. 278.
				1807	....	....	....	*3	J. H. Griscom, M. Rep., 1856, p. 561.
				1808	....	....	....	*1	Ed. N. Y. J. M., 1856, p. 284.
				1809	....	....	....	*2	Ibid.
				1810	....	....	....	*1	Ibid.
				1815	....	....	....	*7	Ibid.
				1816	....	....	....	*0	Ibid.
				1817	....	....	....	*4	Ed. N. Y. J. M., 1856, p. 281.
				1818	....	....	....	*4	Ibid.
				1819	Aug. —	....	....	37	Ibid.
				1820	....	....	....	*2	Ibid.
				1821	....	....	....	*16	Ibid.
				1822	July 10	....	Nov. 5	230	Ibid.
				1823	....	....	....	*5	Ibid.
				1824	....	....	....	*8	Ibid.
				1825	....	....	....	*1	Ibid.
				1826	....	....	....	*2	Ibid.
				1827	....	....	....	*4	Ibid.
				1828	....	....	....	*0	Ibid.
				1829	....	....	....	*0	Ibid.
				1830	....	....	....	*1	Ibid.
				1832	....	....	....	*1	Ibid.
				1833	....	....	....	*2	Ibid.
				1834	....	....	....	*1	Ibid.
				1835	....	....	....	*2	Ibid.
				1838	....	....	....	*8	Ed. N. Y. J. M., 1856, p. 284.
				1839	....	....	....	*4	Ibid.
				1843	....	....	....	*5	Ibid.
				1844	....	....	....	*2	Ibid.
				1846	....	....	....	*0	Ibid.
				1847	....	....	....	*0	Ibid.
				1848	Aug. 12	....	....	*12	Ibid. and Trans. A. M. A., vol. 7, p. 162.
				1852	....	....	....	*1	Ed. N. Y. J. M., 1856, p. 284.
				1853	....	....	....	*14	Ibid.

* Star indicates the reports of deaths at the Marine Hospital, N. Y., for the respective years. — Ed. N. Y. J. M., 1856, p. 284.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
New York......	New York Co...........	A Port, 18 miles from ocean.	35	1854				*20	Ed. N. Y. J. M., 1856, p. 284.
				1855				*5	Ibid.
				1872					B. M. and S. J., vol. 80, No. 23, p. 587.
				1873	May 23		Oct. 30	18	Heber Smith, Rep. Sup. Surg. U. S. M. H. S., 1873.
	Queensborough, Orange Co.			1801					J. G. Scott, M. Repos., 1807, p. 202.
	Red Hook, Dutchess Co....	On Hudson River..........	30	1856					Va. M. J., 1856, p. 328.
	Stapleton and Tompkinsville, Staten Island, Richmond Co.	New York Bay.............	20	1848	Aug. 23				A. B. Whiting, Ch. M. J. and Rev., 1848, p. 613, and Dr. A. Vaché, Rep. to N. Y. Ass.
				1856	July 14		H'rd Frost Oct. 28	25	E. Harris, Rep. to Legislature, 1857.
	West Neck, Suffolk Co.....		18	1795					Dr. D. Hosack, M. and Philos. Reg., 1813, p. 191.
	West Point, Orange Co.....	On Hudson River..........	25	1804					J. G. Scott, M. Repos., 1807, p. 242.
	Yellow Hook..............		20	1856					Va. M. J., 1856, p. 328.
North Carolina..	Beaufort, Carteret Co.......	Newport River, near the sea	8	1854					
				1864	Sept. 24		Nov. 17	68	Official Report, U. P. Rice, 1864.
				1871					
	Newbern, Craven Co.......	On Neuse River............	20	1799					M. Repos., 1800, p. 197.
				1864	Sept. —		Nov. —	700	Report Medical Inspector U. S. A., Dec. 31, 1864, and E. Harris' San. Mem., pp. 247, 249.
	Smithville, Brunswick Co...	On Cape Fear River, near the ocean.	15	1862					W. T. Wragg, N. Y. J. M., vol. ix., No. 5, 1859, p. 49.
	Washington, Beaufort Co...	On Tar River, 40 miles from Pamlico Sound.	35	1800					M. Repos., 1800, p. 197.
	Wilmington, New Hanover Co.	On Cape Fear River, 34 miles from the sea.	25	1796					J. H. Griscom, N. Y. J. M., p. 369.
				1800					M. Repos., 1800, p. 197.
				1821	Aug. 9				J. Hill, A. M. Rec., 1822, p. 86, and Brown, Quarantine, p. 18.
				1862	Aug. 6		Nov. 17	446	W. T. Wragg, N. Y. J. M., 1869, pp. 225, 478.
Ohio...........	Cincinnati, Hamilton Co...	On Ohio River.............	550	1871					Med. and Surg. Rep., vol. 25, No. 16, p. 354.
				1873					Health Office Report.
	Gallipolis, Gallia Co........	On Ohio River.............	520	1796					A. Ellicott, M. Repos., 1801, p. 74.
Pennsylvania....	Bald Eagle Valley, Clinton Co.	Centre of Pennsylvania, on West Branch of Susquehanna River.	550	1799					W. Harris, M. Repos., 1801, p. 75.
	Chester, Delaware Co......	On Delaware River........	25	1798				50	J. H. Griscom, Visitations of Yellow Fever, p. 9.
	Chester County	On Delaware River........		1805					Dowler, Tables of Fever, p. 13.
	Kensington, Philadel'ia Co.	On Delaware River........	15	1793					La Roche, Yellow Fever, p. 68.

Pennsylvania....	Lisburn, Cumberland Co...	On Yellow Breeches Creek, 9 miles from Harrisburg..	250	1803	Aug. —	......	....	......	W. Baldwin, Med. Mus., 1805, p. 67.
	Marcus Hook, Delaware Co.	On Delaware River.........	15	1798	....	......	....	......	J. Rush, Med. Mus., 1805, p. 62.
	Nittany, Centre Co.........	Far inland................	550	1799	....	......	....	......	W. Harris, M. Repos., 1801. p. 75.
	Philadelphia, Philadelphia Co.	On Delaware River.........	35	1695	....	......	....	......	J. N. Schoolfield, Va. M. J., 1857, p. 358.
				1699	Aug. 1	......	....	220	R. La Roche, Ch. M. J. and Rev., 1852, p. 58.
				1732	....	......	....	......	Daily Shreveport Times, vol. 2, No. 311, 1873.
				1741	....	......	....	250	J. H. Griscom, Visitations of Yellow Fever, p. 3.
				1742	....	......	....	......	B. Dowler, Tableau of Yellow Fever, p. 3.
				1743	....	......	....	......	Ibid.
				1744	....	......	....	......	R. La Roche, Ch. M. J. and Rev., 1852, p. 458.
				1747	....	......	....	......	Ibid.
				1762	Aug. —	......	Nov. —	......	J. H. Griscom, Visitations of Yellow Fever, p. 5.
				1791	....	......	....	......	
				1793	Aug. 15	......	Dec. —	4,041	Carey, Account of the Malignant Fever, p. 116.
				1794	....	......	....	......	La Roche, Board of Health Rep., Phila., 1870, p. 53.
				1796	....	......	....	......	J. H. Griscom, N. Y. J. M., 1856, pp. 368, 369.
				1797	Aug. 1	......	Oct. 15	1,300	Rush, Epidemic of 1797.
				1798	Aug. 1	......	Nov. 1	3,500	Ibid.
				1799	July —	......	Nov. —	1,000	R. La Roche, Ch. M. J. and Rev., 1852, p. 458.
				1800	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1801	....	......	....	......	Ibid.
				1802	....	......	....	307	Ibid.
				1803	....	......	....	195	Ibid.
				1805	....	......	....	3-400	Ibid.
				1807	....	......	....	3	B. Dowler, Tableau of Yellow Fever, 1853, p. 14.
				1809	....	......	....	......	Ibid.
				1810	....	......	....	3	Ibid.
				1811	....	......	....	5	Ibid.
				1813	....	......	....	6	Ibid.
				1814	....	......	....	7	Ibid.
				1815	....	......	....	2	Ibid.
				1816	....	......	....	2	Ibid.
				1819	....	......	....	13	S. Emlen, N. A. M. and S. J., 1828, p. 321.
				1820	July 24	......	....	83	S. Jackson, A. M. Rec., 1821, p. 689.
				1853	July 19	......	Oct. —	128	W. Jewell, N. Y. J. M., 1854, pp. 149, 246, and Brown, Quarantine, p. 10.
				1854	....	......	....	......	Ed. Nash. J. M. and Surg., 1854, p. 345.
				1870	June 29	......	....	18	La Roche, Yellow Fever, 1870, pp. 20, 26.
	Southwark, Philadelphia Co.	On Delaware River........	20	1793	....	......	....	......	Ibid., p. 68.
Rhode Island...	Block Island...............	In Long Island Sound......	20	1801	June —	......	Dec. —	......	Aaron C. Willey, M. Repos., 1803, p. 123.
	Bristol, Bristol Co.........	On Narragansett Bay.......	20	1795	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1796	....	......	....	......	Ibid.
				1797	....	......	....	......	Ibid.
	Newport, Newport Co......	On Narragansett Bay.......	20	1806	....	......	....	......	
	Providence, Providence Co.	On Narragansett Bay......	35	1794	....	......	....	......	B. Dowler, Tableau of Yellow Fever, 1853, p. 7.
				1795	....	......	....	45	W. Hume, Ch. M. J. and Rev., 1860, p. 24.
				1797	Aug. 13	......	Aug. —	45	Ibid., p. 234.
				1800	....	......	....	......	Ibid., p. 24.
				1805	July 19	......	Aug. —	......	P. Bowen, Yellow Fever in Providence in 1805.
	Westerly, Washington Co...	On Pawcatuck River.......	25	1798	....	......	....	......	J. Comstock, M. Reprs., 1807, p. 23.
				1805	....	......	....	......	Ibid.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
South Carolina..	Charleston, Charleston District.	A seaport..................	10	1699	....	......	....	......	Simons' Trans. S. C. Med. Ass'n, 1851, p. 37.
				1703	....	......	....	......	Ibid.
				1728	....	......	....	......	Ibid.
				1732	May —	......	Sep. or Oct.	*8–12	Simons' Trans. S. C. Med. Ass'n, 1851, p. 37, and Trans. A. M. A., vol. 23, p. 291.
				1734	....	......	....	......	T. Harris, Phil. M. and P. J., No. 5, p. 21.
				1739	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1854, p. 145.
				1745	....	......	....	......	Ibid.
				1748	....	......	....	......	Ibid.
				1753	....	......	....	......	Ibid.
				1755	....	......	....	......	Ibid.
				1761	....	......	....	......	T. Harris, Phil. M. and Ph. J., 1805, p. 21.
				1762	....	......	....	......	Dawson and De Saussure, Census of Charleston.
				1768	....	......	....	......	M. M. Dowler, N. O. M. J., 1859, p. 305.
				1770	....	......	....	......	T. Harris, Phil. M. and Ph. J., 1805, p. 21.
				1792	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1852, p. 145, and Simons' Trans. Med. Ass'n S. C., 1851, p. 38.
				1794	....	......	....	......	Ibid.
				1795	....	......	....	......	Ibid.
				1796	....	......	....	......	Ibid.
				1797	....	......	....	......	Ibid.
				1798	....	......	....	......	T. Y. Simons, Ch. M. J. and Rev., 1851, p. 779.
				1799	....	......	....	239	W. Hume, Ch. M. J. and Rev., 1854, p. 145, and Simons' Trans. Med Ass'n S. C., 1851, p. 38.
				1800	....	......	....	184	Ibid.
				1802	....	......	....	96	Ibid.
				1803	....	......	....	......	Simons' Transactions S. C. Med. Association, 1851, p. 37.
				1804	....	......	....	148	Ibid.
				1805	....	......	....	......	Ibid.
				1807	....	......	....	162	Ibid., p. 38.
				1812	....	......	....	......	W. Hume, Ch. M. J. and Rev., 1854, p. 145.
				1817	July —	......	Nov. —	272	Dowler, N. O. M. J., 1859, p. 597.
				1819	Aug. —	......	Oct. —	177	Ibid.
				1822	June —	......	Aug. —	2	Ibid.

* Average No. deaths daily.

South Carolina..	Charleston, Charleston district.	A seaport		1824	Aug. —		Nov. —	235	Dowler, N. O. M. J., 1859, p. 597.
				1825	Aug. —		Sept. —	2	Ibid.
				1827	Aug. —		Nov. —	64	Ibid.
				1828	Aug. —		Sept. —	26	Ibid.
				1830	Sept. —		Nov. —	30	Ibid.
				1834	Aug. —		Oct. —	49	Ibid.
				1835	Aug. —		Sept. —	25	Ibid.
				1838	Aug. —		Nov. —	351	Ibid.
				1839	June —		Oct. —	134	Ibid.
				1840	Aug. —		Oct. —	22	Ibid.
				1841*					Simons' Trans. S. C. Med. Ass'n, p. 59.
				1843			Nov. —	1	Dowler, N. O. M. J., p. 597.
				1849	Aug. —		Nov. —	125	Ibid.
				1852	Aug. —		Nov. —	310	Ibid.
				1854	Aug. —		Nov. —	627	Ibid.
				1856	Aug. —		Nov. —	211	Ibid.
				1857	Sept. —		Nov. —	13	Ibid.
				1858	July —		Dec. —	717	Ibid.
				1862					Brown, Quarantine, p. 29.
				1864	July 27				Trans. A. M. A., vol. 23, p. 292.
				1871	July 19		Nov. —	213	Simons' Trans. A. M. A., vol. 23, p. 293.
	Beaufort, Beaufort district	On an arm of the sea	10	1871	Aug. 6		Nov. 21	7	Trans. A. M. A., vol. 23, p. 331.
	Columbia, Richland district	On Congaree River	200	1854					Ed. Nash, J. M. and S., 1854, p. 345.
	Fort Moultrie	In Charleston Harbor	15	1852					M. M. Dowler, N. O. M. J., 1854, p. 305.
				1858	Aug. 15				Ch. M. J. and Rev., 1858, p. 844.
	Georgetown, and district	On Winyaw Bay	10	1854	Aug. 20		Oct. 28		W. C. Miller, Ch. M. J. and Rev., 1856, p. 19.
	Hilton Head		10	1862	Sept. 8		Oct. 25		E. Harris' San. Com. Memoirs, pp. 244, 247, and Brown, Quarantine, p. 30.
	Mount Pleasant, Charleston Co.	On Winyaw Bay	10	1817					R. A. Kinloch, Ch. M. J. and Rev., 1858, p. 793.
				1848					Ibid.
				1852					Ibid.
				1854					Ibid.
				1856					Ibid.
				1857					Ibid.
Tennessee......	Memphis, Shelby Co	On Mississippi River	260	1853					W. J. Tuck, N. O. M. and S. J., 1854, p. 662.
				1855					A. P. Merrill, Galv. M. J., 1867, p. 861.
				1866					Ed. Amer. Prac., vol. 8, 1873, p. 319.
				1873	Sept. 14		Nov. 9	1244	Memphis Board of Health. See G. B. Thornton, in Report of Supervising Surgeon U. S. Mar. Hos. Service, 1873.
Texas..........	Alleyton, Colorado Co	On Colorado River	250	1867	Sept. 4		Dec. —	45	Trans. A. M. A., vol. 19, p. 289.
	Anderson, Grimes Co	140 miles east by north of Austin, near Brazos River.	200	1867					Ibid., p. 275.
	Austin, Travis Co	On Colorado River	450	1867					Galv. M. J., 1867, vol. 2, No. 10, p. 930.
	Bastrop, Bastrop Co	On Colorado River	260	1867					Trans. A. M. A., vol. 19, p. 275.
	Beaumont, Jefferson Co	On Neches River	50	1863					Brown, Quarantine, p. 71.
	Belleville, Austin Co	110 miles east-southeast of Austin, near Brazos River.	180	1855				1	J. Stephens, N. O. M. and S. J., 1856, p. 60.
	Brazoria, Brazoria Co	Near the Gulf of Mexico	20	1859					B. Dowler, N. O. M. J., 1860, p. 443.
	Brenham, Washington Co	20 miles from Brazos River	350	1867	Aug. 11		Oct. 31	120	Trans. A. M. A., vol. 19, p. 275.

* Not within the incorporated city limits of Charleston.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.* — (*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea-level.	Date of Commencement. Year.	Date of Commencement. Month.	Date of Suspension. Year.	Date of Suspension. Month.	Mortality.	Authority.
Texas	Brownsville, Cameron Co...	On Rio Grande River......	25	1853	Sept. 23	......	Dec. 23	50	Army Medical Statistics, p. 353.
				1858	Aug. —	......	Nov. —	41	S. Chaillé, N. O. M. and S. J., 1858, p. 811.
				1862	....	......	....	......	Galv. M. J., 1866, p. 170.
	Calvert, Robertson Co......	Between the Brazos and Navasota River.	325	1867	Oct. 12	1868	Jan. 10	250	
				1873	....	......	....	......	Newspapers.
	Chapel Hill, Washington Co.	Near Brazos River.........	200	1867	Aug. 6	......	Dec. —	123	Trans. A. M. A., vol. 19, p. 275.
	Columbus, Colorado Co.....	On Colorado River.........	250	1873	....	......	....	......	Newspapers.
	Columbia, Brazoria Co......	On Brazos River...........	25	1833	....	......	....	132	Galv. M. J., 1866, p. 163.
	Corsicana, Navarre Co.....	180 miles north northeast of Austin, near the Pecan River.	425	1873	....	......	....	......	Newspapers.
	Corpus Christi, Nueces Co..	On Corpus Christi Bay....	15	1862	....	......	....	......	Galv. M. J., 1866, p. 170, and E. Harris' San. Mem., [p. 250.
				1867	Aug. —	......	....	......	Brown, Quarantine, p. 70.
				1873	....	......	....	......	Newspapers.
	Cypress City, Harris Co....	Near Cypress Bayou, a branch of the San Jacinto River.	60	1853	....	......	....	......	Galv. M. J., 1866, p. 169.
				1859	....	......	....	......	B. Dowler, N. O. M. J., 1860, p. 443.
	Danville, Montgomery Co..	On branch of the San Jacinto River.	160	1867	....	......	....	......	Trans. A. M. A., vol. 19, p. 496.
	Edinburg, Cameron Co.....	On Rio Grande River......	100	1859	July —	......	....	13	B. Dowler, N. O. M. J.. 1860, p. 443.
	Goliad, Goliad Co..........	On San Antonio River......	50	1867	July 12	......	....	23	Trans. A. M. A., vol. 19, p. 284.
	Galveston, Galveston Co....	On an island in Galveston Bay.	5	1839	Sept. 30	......	Oct. 11	250	Galv. M. J., 1867, p. 856.
				1844	July 5	......	....	400	Ibid., p. 838.
				1847	Oct. 1	......	Nov. 25	200	Ibid., p. 838.
				1853	Aug. 16	......	Nov. 28	536	Ed. Med. and Surg. Rep., vol. 17, 1867, No. 14, p. 297.
				1854	Aug. 9	......	Nov. 5	404	Ibid.
				1858	Aug. 27	......	Nov. 14	344	Ibid.
				1859	Sept. 17	......	Nov. 30	182	Ibid. [250, 251.
				1864	Sept. 1	......	Nov. 20	259	Ibid., and Dr. Warner, in E. Harris' San. Mem., pp.
				1866	....	......	....	......	Galv. M. J., 1866, p. 338.
				1867	June 26	......	Nov. —	1,150	S. M. Welch, Galv. M. J., vol. 1, No. 2, p. 83.
	Harrisburg, Harris Co......	On Buffalo Bayou..........	55	1867	....	......	....	......	Trans. A. M. A., vol. 19, p. 289.
	Hempstead, Austin Co.....	50 miles from Houston, and near Brazos River.	166	1859	....	......	....	......	B. Dowler, N. O. J. M., 1860, p. 443.
				1867	Aug. 9	......	Nov. 26	151	Trans. A. M. A., vol. 10, p. 275.
	Hockley, Harris Co........	Near Buffalo Bayou........	50	1853	....	......	....	......	Galv. M. J., 1866, p. 169.

Texas	Houston, Harris Co.	On Buffalo Bayou	37	1839					W. McCraven, N. O. M. N., 1860, p. 105.
				1844					Ibid.
				1847					Ibid.
				1848					Ibid.
				1853					Ibid.
				1854					Ibid.
				1858					Ibid.
				1859					Ibid.
				1864					Galv. M. J., 1866, p. 163.
				1870			Oct. —	1	Ibid., 1870, p. 296.
	Huntsville, Walker Co.	200 miles east by north of Austin.	200	1867	Aug. 9		Oct. 19	130	Trans. A. M. A., vol. 19, p. 275.
	Independence, Washington Co.	80 miles east of Austin, near Brazos River.	250	1867					Ibid., p. 289.
	Indianola, Calhoun Co.	On Matagorda Bay	10	1852	Sept. —				Indianola Bulletin, Dec. 16, 1870.
				1853					Brown, Quarantine, p. 68.
				1858					Heard, Rep. Epid. of Texas, p. 15.
				1859					B. Dowler, N. O. M. J., 1860, p. 443.
				1862					Brown, Quarantine, p. 68.
				1867	June 20			80	Trans. A. M. A., vol. 19, p. 268.
	La Grange, Fayette Co.	On Colorado River	450	1867	Aug. —		Nov. —	200	Ibid., p. 275.
	Liberty, Liberty Co.	On Trinity River	40	1867					Ibid., p. 289.
	Liverpool, Brazoria Co.	36 miles west of Galveston, near Chocolate River.	25	1853	Aug. —			4	Galv. M. J., 1866, p. 169.
	Matagorda, Matagorda Co.	On Matagorda Bay	15	1862				120	Ibid., p. 170.
				1863					Trans. A. M. A., vol. 19, p. 266.
	Millican, Brazos Co.	Near Brazos River	300	1864					Galv. M. J., 1866, p. 175.
				1867	Oct. 15		Nov. 12	4	Trans. A. M. A., vol. 19, p. 275.
	Montgomery, Montgomery Co.	Near San Jacinto River	180	1859					B. Dowler, N. O. J. M., 1860, p. 443.
	Navasota, Grimes Co.	On the Navasota River	200	1867	Aug. 12		Dec. —	154	A. R. Kilpatrick, Galv. M. J., 1868, vol. 1, No. 3, p. [182.
	Oldtown, near Indianola		20	1867	Oct. 13				Trans. A. M. A., vol. 19, p. 268.
	Port Lavacca, Calhoun Co.	On Lavacca Bay	15	1867	July 3		Oct. 29		Ibid., p. 283.
	Richmond, Fort Bend Co.	On Brazos River	125	1853					Galv. M. J., 1866, p. 163.
				1859					B. Dowler, N. O. M. J., 1860, p. 443.
	Rio Grande City, Starr Co.	On Rio Grande River	200	1867				150	Heard, Epidemic Diseases of Texas.
	Sabine City, Jefferson Co.	On Sabine Lake	10	1863	July —		Oct. 1	14	Galv. M. J., 1866, p. 170.
	Saluria, Calhoun Co.	On Matagorda Island	10	1853					
	Sugarland, Fort Bend Co.	On Brazos River	100	1859					B. Dowler, N. O. M.J., 1860, p. 443.
	Victoria, Victoria Co.	On Guadaloupe River	50	1867	Aug. 1		Dec. 25	200	Trans. A. M. A., vol. 19, p. 284.
	Alexandria, Alexandria Co.	On Potomac River	25	1803	Aug. 1			200	Dr. Dick, Med. Repos., 1804, p. 190.
	City Point, Prince George Co.	On James River	15	1798					Currie, Memoirs of Yellow Fever, p. 109.
	Gosport, Norfolk Co.	On Elizabeth River	20	1855					J. A. Manning, Va. M. J., 1857, p. 288.
Virginia	Hampton Roads	Harbor		1869					Brown, Quarantine, p. 18.
	Norfolk, Norfolk Co.	On Elizabeth River	20	1747					Daily Shreveport Times, vol. 2, No. 311, 1873.
				1794					J. H. Griscom, N. Y. J. M., 1856, p. 369.
				1795					Ibid.
				1796					W. Selden, Va. M. J., 1857, p. 95.
				1797					J. H. Griscom, N. Y. J. M., 1866, p. 369.
				1798					Va. M. J., 1857, p. 95.
				1799					Ibid.

Table of Localities in the United States where Yellow Fever has appeared since 1668, *etc.*—(*Continued.*)

State.	Locality.	Situation.	Elevation, in feet, above sea level.	Date of Commencement.		Date of Suspension.		Mortality.	Authority.
				Year.	Month.	Year.	Month.		
Virginia........	Norfolk, Norfolk Co.......	On Elizabeth River........	20	1800	July 26	......	Oct. 30	250	Med. Repos., vol. 4, p. 329.
				1801	....	......	....	......	W. Selden, Va. M. J., 1857, p. 95.
				1802	....	......	....	......	Ibid.
				1803	....	......	....	......	Ibid.
				1804	....	......	....	......	Ibid.
				1805	....	......	....	......	Ibid.
				1821	Aug. 1	......	....	......	Va. M. J., 1857, p. 95.
				1826	Sept. 1	......	....	......	Committee's Report, p. 14.
				1845	....	......	....	......	Schoolfield, Va. M. J., 1857, p. 439.
				1852	Aug. 7	......	....	......	Va. M. J., 1857, p. 95.
				1854	Oct. —	......	Nov. 2	3	Ibid.
				1855	June 30	......	Oct. —	1,807	Portsmouth Relief Association Report.
	Petersburg, Dinwiddie Co ..	On Appomattox River	20	1798	....	......	....	......	Currie, Memoirs Yellow Fever, p. 109.
	Portsmouth, Norfolk Co....	On Elizabeth River........	20	1852	....	......	....	......	Portsmouth Relief Association Report, p. 91.
				1854	....	......	....	......	Ibid., p. 91.
				1855	Aug. 1	......	Oct. —	1,000	Ibid , p. 77.
	Richmond, Henrico Co.....	On James River............	50	1806	....	......	....	......	M. Repos., 1807, p. 215.
	Scott's Creek, near Portsmouth.	....	15	1855	June 29	......	....	......	J. A. Manning, Va. M. J., 1857, p. 29.
	Winchester, Frederick Co...	20 miles from the Blue Ridge Mountains.	700	1804	July —	......	....	......	R. Dunbar, Med. Repos., 1805, p. 252.


MAP
OF
PART OF CITY OF MEMPHIS.
TO ACCOMPANY Dr. ERSKINE'S REPORT ON YELLOW FEVER.
Yellow line is Boundary of Infected District.
Fine lines are Contour Lines. (Numerals on each mark the altitude)
The hair-line figures indicate the height of the lines above the City datum plane, which datum plane is 120 ft. above tide water at the Gulf.
High water is 100.8 and low water 67 ft. above the datum plane.
E
N
S
W
LOONEY ST.
SAFFARANS
GREENLAW
MILL
SYCAMORE
AUCTION
CONCORD
OVERTON
JACKSON
COMMERCE
WINCHESTER
MARKET
EXCHANGE
POPLAR
WASHINGTON
ADAMS
JEFFERSON ST.
QUIMBY
RALEIGH
ALABAMA
THORNTON
CARROLL
FOURTH
THIRD
SECOND
MAIN
FRONT
PROMENADE
NAVY YARD
FULTON
WALNUT
DOCK ST.
CYPRESS
HAPPY HOLLOW
Bayou
Gayoso
Market House
Jail
Pond
Riley's House
Centre Landing
Steam Tug "Bee" landed here
L.R.&F. Depot
WOLF RIVER
MISSISSIPPI RIVER

A REPORT ON YELLOW FEVER AS IT APPEARED IN MEMPHIS, TENN., IN 1873.

By JOHN H. ERSKINE, M. D.,

Late President of Board of Health, Memphis.

I PROPOSE in the presentation of this paper to confine myself strictly to an account of the epidemic of yellow fever as it has prevailed in Memphis during the present season. Its origin is involved in some obscurity, but after the most careful investigation I think there is but little if any doubt that it was imported.

On the 2d of August, the steam-tug *Bee*, with barges in tow, commanded by Captain C. B. Gall, left New Orleans for St. Louis, having taken on board an old man, William Davis, as a deck hand. During the trip to Memphis, which was completed August 10, he, the captain, and several of the crew were attacked with what was regarded by three physicians, one each at Helena, Memphis, and Osceola, Ark., as malignant bilious fever. At Memphis, Davis left the boat and entered the cabin of an Irishman, where he died in a few hours; the captain got as far as Osceola, where he died August 11. His body was brought back to Memphis, and lay for several hours on the wharf-boat uncoffined, having given every evidence of death from yellow fever. Within a few days after the death of Davis, Riley the Irishman, with one or more members of his family, died with a disease supposed to be malignant bilious remittent, now known to have been yellow fever. From this cabin it began to extend, and must have gained firm footing before its true character was recognized. The first case positively known to be yellow fever was reported by the hospital physician, Dr. G. B. Thornton, September 2.

PREDISPOSING LOCAL CONDITIONS.

Without springing the issue as to whether yellow fever could originate in Memphis *de novo*, I will state that the local conditions surrounding this portion of our river front were such as to have originated almost any disease, and certainly to have intensified one naturally as malignant as this one. Its topography is this. What in Memphis is styled "Happy Hollow" is a very low flat area of about four acres, immediately on the river near the northern limit of the city. It is under the Chickasaw bluffs, so sunken that during high water it is largely submerged, and after the tide has fallen is left partially covered with stagnant ponds and slimy ooze, whose exhalations are noisome and offensive. Its soil is alluvial, and upon this garbage has been continuously thrown, until it has become extremely filthy. It is the natural drain for the gutters of the overhanging bluffs, through which the sewage steadily trickles. It is in addition the home of a low class of Irish, and the

favorite landing-place of flats and rafts, whose occupants are proverbial for their carelessness and uncleanliness. During the hot summer months this accumulated mass of filth has been festering and rotting in the sun, exhaling mephitic gases, which in themselves are potent enough to induce infection, only needing the germ of yellow fever to be sown to yield all the fearful fruits of this great epidemic. Such was its origin and such the locus from which it started. It must have begun about the middle of August, but its first advances were made so gradually it was not publicly pronounced epidemic by the then existing Board of Health, till September 15. How powerful a footing had it gained within that period of inaction on the part of the city authorities. It had swept "Happy Hollow," had climbed the hill, stolen over the bluff, and had attacked the city over one third of its extent. It had moved in a northeasterly and northern direction, having confined itself to the "infected district" until towards the close of the epidemic it was visiting nearly every ward in the city. It has not been influenced by the direction of the winds, nor does it seem to have spread from persons coming from North Memphis, its habitat, into the southern parts of the city.

ITS NATURAL HISTORY AND SYMPTOMS.

Its natural history and symptoms are so similar to the descriptions given of yellow fever by the physicians of New Orleans and Mobile, no one could fail to recognize it as the same disease. Climatic laws seem not to have modified it in any material way. It began its invasion with a chill, most often with chills which lasted from one to several hours, before the accession of the fever. The distinct chill was the initial symptom. The fever usually rose within two hours thereafter, there being often an insensible gliding from the one into the other. This was ushered in by intense frontal and occipital head-ache, pain in the back and limbs, more particularly over the lumbar region, accompanied by a hot, pungent, burning skin, a quick, soft, frequent pulse; eyes suffused and watery, with conjunctiva injected, and the tongue either long, narrow, and acuminated, or broad, flat, and swollen, covered with a thin, whitish film over the centre of its dorsum, which in twenty-four hours increased to a thick cottony coat.

To describe more minutely the most prominent and striking features of this disease, let me detail the different appearances of the tongue, and the records of the temperature and pulse. The tongue presented three different appearances. In mild cases it retained the thin film, or a slight yellowish tinge, such as would have been observed in a light bilious attack. In more severe cases the white coat increased in thickness, covered the entire dorsum from the tip to its root, leaving a distinct, clearly defined uncoated margin from one eighth to one quarter of an inch all round. I can best suggest the comparison of trimming white paper into its shape and fitting it accurately, but cutting it just so much (one quarter of an inch) smaller than the tongue. This white fur did not disappear with the fever, but remained during the period of calm to slowly clean from the tip, which remained red and watery. Again there was either the dry, brown tongue of typhoid fever, or the dirty brown, slimy, sticky tongue of malignant typhoid pneumonia.

A third variety was the strawberry tongue, red as raw beef, with its acuminated papillæ denuded of epithelium, accompanying and foreshadowing a hemorrhagic tendency from gums, lips, and nares. Its malignant appearance as it is quickly protruded or feebly doubled up under the lower teeth, are fearful signs of prostration and impending dissolution.

THE THERMOMETRICAL OBSERVATIONS.

I employed the thermometer with constant and increasing interest during the entire epidemic. It is the most unerring test we have of the progress of this fever. There is such an exceptional want of correllation between the pulse and the temperature in yellow fever the tactus eruditus cannot be relied on. There was but one paroxysm, the duration of which varied from twenty-four hours to seven days. We have been taught by the authorities that yellow fever lasts but seventy-two hours. This is disproved by more careful observation. Long after the pulse had fallen to seventy-five, and the skin had cooled, the thermometer registered from one to two degrees of preternatural heat. The fever in cases which progressed regularly and favorably reached its greatest intensity within the first twenty-four hours of the attack, usually reaching 102° and 103°, after which it would decline about 1°, preserving this range for two days longer, and then slowly decline, passing off from the third to the fifth day. In dangerous or fatal cases it would continue to rise to 104° and higher, till the fourth day, after which it declines very rapidly for from one to two days, leaving the patient in a state of alarming or fatal prostration, death beginning at the heart. In other cases just before death it would rise to 105°, 106°, and above this height. The pulse would ascend with the temperature during the initiatory fever, reaching from one hundred and twelve to one hundred and forty, beating with a quick, soft, nervous thrill, after which it would fall lower in proportion than the temperature, and continue slow throughout the attack. Until the complete defervescence of the fever it would range from one hundred and four to ninety-two and eighty-eight, after which, and often during the fever, it would fall to seventy-five, and in the period of convalescence descend as low sometimes as thirty-six, the temperature remaining at 98.5° or reducing to 96°.

ANOMALOUS ACTION OF THE PULSE.

This "slowing" of the pulse presents some anomalous features as curious as interesting. While it descends it becomes strong, full, large, and tense, like a whip cord. It beats ominously, and yet there is nothing in the appearance or feelings of the patient which would indicate danger. He is often cheerful, says he feels entirely well, is hungry; wishes to get up: his kidneys are acting freely. It is only on an attempt to rise that he feels the lack of the stimulus of blood to the brain. I saw no case in which this condition existed which did not terminate favorably. It is a valuable sign of convalescence. The teaching, therefore, that yellow fever is a seventy-two hour fever is an error. This is by no means absolute. The paroxysm may last seven days without remissions, and upon the authority of one of our best

observers here, there was one case in which the fever lasted twenty-one days, and then terminated with black vomit. The kidneys, as in other epidemics, became the great point of anxiety. In favorable cases they performed their function regularly as in other febrile affections, and in those who recovered the rule was now albuminous urine. In fatal cases there was either an entire suppression, or a highly albuminous secretion, which appeared about the third day of the fever and continued throughout.

THE FATAL SIGN.

Suppressed urine was the fatal sign, *not* the black vomit; but all cases of black vomit, with suppression of urine, were fatal; whereas a larger proportion of cases of black vomit than usual recovered where the urinary secretion was not suspended. I am kindly permitted by Dr. Samuel J. Morrison of this city to make the following statement in regard to cases of black vomit occurring in his practice. His cases numbered 256; of these 193 recovered, 63 died. Of those who recovered eight had black vomit; thirty died with it. All of those who recovered from this symptom were under twenty-four years of age, except two married women, aged twenty-five and forty. All the cases treated were in the infected district but eighteen, of whom three died. In cases of females there was almost invariably a return of the catamenia profuse and free, with a mitigation of the symptoms, but with a prolongation of the fever. I saw but one case in which it was retarded. The disease was very fatal to pregnant women, causing frequent abortions, and resulting in death from exhaustion. This was the observation in the epidemic of 1867.

INFECTIOUS, NOT CONTAGIOUS.

In regard to its contagiousness I think I can add my testimony to that of higher authority against this. It is not contagious; its fearfully infectious character is beyond dispute. As in other epidemics so in this it began from one centre which in this instance was the water's edge, and required one month to travel over the distance of a quarter of a mile before it acquired sufficient momentum from its accumulating materies morbi to diffuse itself over the northern half of the city. It obeyed the law of gradual extension, and spread from house to house, and street to street. After this it began to appear in different centres at variable distances, and in which no contact or even apparent reasonable probabilities of exposure existed. Frosts did not destroy it entirely, it demanded ice to kill it. During the prevalence of the fever all other diseases seemed to have been entirely subordinated. Malaria was dethroned and overwhelmed. Cases of intermittent and remittent fever which at this season are so frequent in this latitude almost entirely disappeared. A class of cases of unusual malignity were pronounced congestion. These were in all probability from overwhelming doses of this specific poison. The percentage of deaths during the epidemic from yellow fever is five for the population at large, fifty for the City Hospital and the Walthal Infirmary.[1] Memphis claims a population of 50,000; of these 20,000

[1] The reason of the great mortality in the hospital and infirmary was that the worst class of cases was sent to these for treatment, many in a dying condition. The medical attendance was equal to that of the cases treated outside.

fled the city. Out of the 30,000 remaining, 1,500 died of the fever. If we reduce this number to those in and near the infected district, or to those actually attacked, the percentage would be not exceeding fifteen. I wish to state a fact, the significance of which is confirmatory of that of Dr. J. C. Nott, in regard to the immunity of prisons. I am the physician of the county jail, a large and commodious building, in which are one hundred and forty prisoners. It is surrounded by a wall fifteen feet high, and is in the heart of the infected district. It has been disinfected every day with carbolic acid, and the fumes of burnt tar. Its cleanliness is exceptional for such abodes. But two cases of yellow fever occurred in it during the entire visitation. One of the cases was at once removed and died. Whether this exemption is attributable to the thorough policing or the wall, is an open question. If this poison is an organic germ and moves near the ground, the wall has barred its ingress. Otherwise disinfectants have destroyed it, and the argument for their constant use is thus far sustained.

THE TREATMENT ADOPTED.

The treatment adopted here was purely expectant. Very little medicine was used, and less is needed in yellow fever than in almost any disease in the nosological tables. It is a self-limited disease, zymotic, will run its course, cannot be aborted, and the least rude interference with it the better. The value of a knowledge of its natural history as revealed by the most patient and careful observation throughout the epidemic, has but confirmed the statements of others. Among these I cannot allude too highly to those of Prof. Joseph Jones, M. D., of New Orleans, whose reports are so accurate and so fully in accord with my own. They detail the most truthful history of the disease. My opposition to the use of quinine as used by him and others in the first twenty-four hours of the attack was based upon a recognized law of a decline in temperature within that time. I did not use it, nor was it generally employed by most of our practitioners. The patient was at once put to bed, the hot mustard foot-bath was administered, the customary dose of castor-oil given, a sufficient number of blankets were placed over him to render him comfortable, and he was let alone. Orange leaf, or any warm tea with neutral mixture, and sweet spirits of nitre with or without tincture of aconite, were given to promote sweating. If the head was unduly hot, cold affusions were employed, and so the body was sponged. Cooling drinks, as cistern or ice-water, were allowed in moderate quantities without the slightest perceptible injury. I think the practice of withholding these is untenable upon any grounds, and ought to be abandoned. The relief is beyond expression, and the cry is for water. Iced champagne was freely used and most gratefully taken. The patient must be controlled in quantity, and it is not necessary in either the champagne or water to have it too cold. During the fever, the stomach was left undisturbed, save by small quantities of green or black tea. My own experience is that while the fever is abating, support and stimulation should be begun carefully at first, more freely afterwards. While in some cases of extreme violence the fever should be undoubedly cooled by cautious sedation. Yet it is a serious question as to whether greater advantage would

not be derived from the earlier administration of stimulants before the patient lets down with the sudden fall which supervenes so rapidly after the decline of the fever. The principal articles of diet were milk punch, beef tea, mutton broth, chicken soup, oyster soup, etc., used at regular intervals in small quantities. If, after the convalescence was well established, it was desired to move the bowels, it was done by an enema. A purgative of any kind induced severe prostration. The important injunction was to confine the patient to bed for ten days. So little apparent muscular prostration is felt while the body is recumbent, it is a difficult matter to impress on him that he is sick, and the most unceasing care is necessary to confine him to bed. Frequent and fatal relapses followed the disregard of this.

THE SALIENT POINTS IN CONVALESCENCE.

The salient points to be guarded were absolute rest, an avoidance of any disturbing influence on the stomach, a steady but not too profuse action of the skin, strict attention to the kidneys, and the most cautious support during convalescence. By pursuing this course yellow fever may be as successfully managed as other malignant fevers.

[APPENDED STATEMENT A.]

MEMPHIS, TENN., *December* 8, 1873.

I can give you no new facts in regard to the steam-tug *Bee.* The officers seem to have felt they would be censured, and have not only been very reticent, but have given a different coloring to the facts. It is beyond dispute the true origin of the fever. During the summer we had other cases brought by steamboats, some of which I saw in person; but at that time it was epidemic here. No other place on the river suffered appreciably from the disease. You will see from the meteorological reports that the wind was north and northeasterly during August, September, and October. The disease moved northward, but was so slow it took a month to spread a few squares. Its progress was from house to house, block to block, and street to street; such evident difference between the slowness of its spread, contrary to the winds, and that of cholera in June, which in a few days was all over the city, show the controlling power of currents of atmosphere in the one (cholera), and a lack of it in the other (yellow fever), which is very striking. Even in the "infected district" it was more malignant in different localities. The relative number of cases on the west side of Main Street to the east side was about four to one. By reference to map the population of the space between Concord, Overton, Promenade, and Front was almost literally annihilated; nine families out of thirteen were swept away, two having fled. The dwellings were of good class.

I have made diligent inquiry in regard to the spread of the disease upon the railroads. The general testimony is that every case which appeared at any of the stations or towns, could be directly traceable to contact with Mem-

phis. On the Louisville railroad, the depot of which is in the infected district, cases appeared at different points, but in no instance did it spread. It was confined to those who had been in the city. At Bartlett, twelve miles out, there were none; while at Wythe, thirty miles out, there were six; at Humboldt, three; at Brownsville, four. On the Memphis and Charleston railroad as far as Huntsville, Ala., where one case developed and died, were there cases; one at Grand Junction, fifty miles; three at Corinth, ninety miles; several at Holly Springs — all of which came from Memphis, and in no case did it extend. In regard to disinfectants they were applied too late. The disease had a hold which they could not dislodge. When the present Board of Health assumed its duties, we had carbolic acid sprinkled from water carts all over the streets and alleys, and in gutters, drains, and vaults. Lime was sown over the entire city. It was cleansed throughout its extent, but there was no perceptible abatement till frost and ice appeared, and it has only absolutely ceased within a fortnight — the last case having been reported during the latter part of November. The only exceptional case where disinfectants were used seems to be the county jail, which was so free from the fever. At the same time I must recall the fact of the wall around it — fifteen feet high — which may have excluded the poison. The City Hospital is on the eastern limit of the city; it received over two hundred cases, but no attendant, of whom there were eighteen, was attacked. No undertaker died. Fourteen physicians developed the fever, and seven died. These are all the material facts, and I hope they will aid you in your reports.

J. H. Erskine, M. D.

[APPENDED STATEMENT B.]

Meteorological Observations during the Epidemic Season.

War Department, Signal Service, U. S. Army.

Table *showing Daily and Monthly Mean of Barometer and Thermometer, Monthly Velocity of Wind, and Amount of Rainfall, with the prevailing Direction of Wind. Station Memphis, Tenn.*

AUGUST.

Barometer, Monthly Means, A. M.	30.063
P. M.	29.989
Midnight	30.033
Highest Barometer	30.211
Lowest Barometer	29.862
Mean Daily Barometer	30.035
Thermometer, Monthly Means, A. M.	74
P. M.	87
Midnight	76
Highest Thermometer	94
Lowest Thermometer	68
Mean Daily Thermometer	79
Mean Daily Humidity	70
Total Rainfall	4.53
Prevailing Wind	North
Total number of miles travelled	2,856
Maximum Velocity of Wind	25 miles per hour

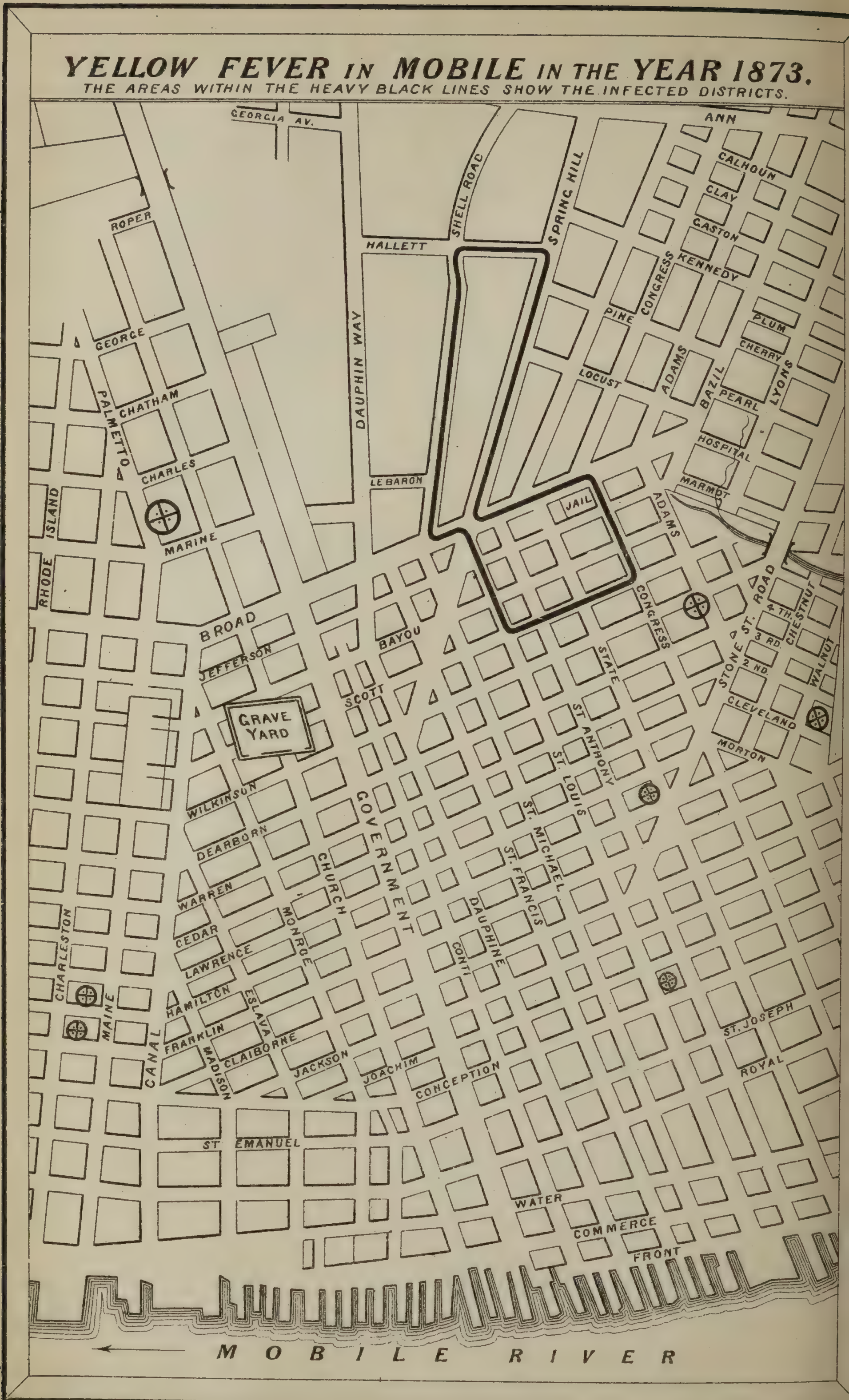
Number of Cloudy Days	3
Number of Rainy Days	2
Partly Cloudy Days	16
Highest stage of Water	14′ 9′

SEPTEMBER.

Barometer, Monthly Means, A. M.	30.083
P. M.	30.013
Midnight	30.053
Highest Barometer	30.281
Lowest Barometer	29.808
Mean daily Barometer	30.048
Thermometer, Monthly Means, A. M.	67
P. M.	78
Midnight	69
Highest Thermometer	92
Lowest Thermometer	53
Mean daily Thermometer	71
Mean daily Humidity	68
Total Rainfall	3.53
Prevailing Wind	Northeast
Total number of miles travelled	3,320
Maximum velocity of Wind	18 miles per hour
Number of Cloudy Days	9
Number of Rainy Days	3
Partly Cloudy Days	11
Highest stage of Water	6′ 2″
Lowest stage of Water	3′ 3″

OCTOBER.

Barometer, Monthly Means, A. M.	30.169
P. M.	30.105
Midnight	30.140
Highest Barometer	30.48
Lowest Barometer	29.76
Mean daily Barometer	30.130
Thermometer, Monthly Means, A. M.	50
P. M.	63
Midnight	54
Highest Thermometer	80
Lowest Thermometer	30
Mean daily Thermometer	56
Mean daily Humidity	66
Total Rainfall	5.95
Prevailing Wind	North
Total number of miles travelled	4,046
Maximum velocity of Wind	32 miles per hour
Number of Cloudy Days	9
Number of Rainy Days	5



YELLOW FEVER IN MOBILE IN THE YEAR 1873.

THE AREAS WITHIN THE HEAVY BLACK LINES SHOW THE INFECTED DISTRICTS.

ENDICOTT & CO. LITH. 57 BEEKMAN ST. N. Y.

AN ACCOUNT OF YELLOW FEVER AS IT PREVAILED IN MOBILE AND VICINITY IN 1873.

By J. T. GILMORE, M. D.,
Mobile, Alabama.

By the Report of the Health Officer, you will see that our first case occurred on the 21st of August. The second was on the 13th of September, and this case created an infected point, from which the disease inclined to spread. Up to the time of Sister Regina's death, September 18, the city was healthy to an almost unparalleled degree ; it was at this time we commenced disinfecting and fumigating systematically.

The red line on the map sent marks out the infected district, around which the acid was applied by means of a water cart, completely encircling it; and the apartments occupied by genuine cases were fumigated with chlorine gas, and the whole premises were thoroughly disinfected when allowed. The other points marked with a red cross, show where single cases occurred, but from which there was no spread of the disease. I must continue my description of this modified fever, which I have already noticed. In its resemblance to real yellow fever, it bears much the same relation that *Varioloid* does to *Variola*, only that it does not beget immunity against a subsequent attack, which real yellow fever as a general rule does. All the alarming symptoms stop short usually on the third or fourth day, and the patient rapidly convalesces. In the infected district, outside of the hospital, where the focus of infection was created, in quite a number of families there would exist one case probably of genuine yellow fever, with a malignant tendency, and the other members of the same household would be down with the modified fever. This fever reminded us in its type of the products we have seen from the blending of the different races : the white man, the negro, and the Indian. We can better illustrate this blending by observing the products of the intermingling of the races, as seen in Mexico. Some of the Mexicans show the Caucasian blood as predominating, others the negro, and still others the Indian. Just so with our modified fever, as we have had it here this year. We have in this climate a season corresponding with the Indian Summer of the North, that peculiarly invites attacks of fever. After our long and relaxing summers, leaving the system enfeebled, the first advent of the cool nights and mornings arresting the free action of the skin, produces a condition that strongly invites the development of fever. In localities where malaria exists, we have malarial fevers, and when the poison of any fever is introduced, this atmospheric condition gives it lodgment and propagation. It is this peculiar climatic condition that gives rise to that form of disease that Aitken describes as

Paludal Yellow Fever, and I believe that the fever we have seen as existing here this season, and in 1867 and 1870, was this fever, with more or less of the specific yellow fever element incorporated with or engrafted upon it, and the presence of those two distinct forms of fever explains to my mind the oftentime heard expression, that every epidemic of yellow fever exhibits different features from the preceding. This paludal or littoral form of fever is a disease of low mortality, and the *real* or *specific* yellow fever is a disease of almost unequaled fatality.

Hence, in my judgment, results the great difference of mortality in different epidemics, which depends upon the fact, whether or not the disease partakes of the paludal or specific type.

In some localities the malarial element predominates, in others the paludal yellow fever, and in a few instances the specific yellow fever claimed the ascendency, and this occurred especially in those enfeebled by age, disease, or habits, and without exception those who have died outside of the City Hospital — save the Sister in the Infirmary, who visited those of her community at the City Hospital almost daily — belonged to that class who were thus predisposed to disease. I believe that this modified fever in such cases would develop all the malignancy of genuine yellow fever.

This disease also exhibits great contagiousness. I am informed that in New Orleans the same type prevailed extensively for some months or more, before it came here, and that it was styled and treated as a "dengue." I witnessed an epidemic of dengue here in the fall of 1866, and assert positively that our disease of this year is essentially a different fever. It is precisely the mild form of yellow fever we had attacking many in 1867 and 1870, as I have already described it.

I have written to Drs. Hodges and Whiting, of Pensacola, asking them to forward a statement of their epidemic, as requested in yours of date mentioned, but as yet have not received an answer. I send you, inclosed, the statement of officer Gidden, who was sent to Pensacola Junction August 11, to establish a quarantine in the railroad communication between this city and Pensacola. I also wrote to Dr. Ford at Pollard, requesting him to forward me a history of the disease at the Junction, but have not as yet received any reply. Pensacola Junction is several miles this side of Pollard, on the Mobile and Montgomery railroad, from which point there is a branch road leading to Pensacola; at Pollard, the home of Dr. Ford, no cases occurred, being a point in the direct line of travel, at which no detention occurred.

I cannot better express my notions of the efficiency of the local means employed here during this season, than by reproducing an extract from the report of the Board of Health to the city authorities: —

"We will commit ourselves to nothing relative to the virtues of the agents employed as destroyers or modifiers of the yellow fever poison or germ, until further experience demonstrates its undoubted efficacy.

"We regard this animalcular notion of disease as an offspring of the materialistic philosophy, that has so largely taken possession of the human mind duting the last thirty years, and look upon its truthfulness with great misgivings and doubts.

"The practical point in the application of the disinfectants, is that it must come in contact with each germ or animalcula to be distinctly efficacious, and it is believed by the New Orleans Board of Health, that carbolic acid must be volatized to reach each germ, and even then some of the germs may escape, and others are only weakened. Cold is the only positive destroyer of the yellow fever poison. It is thought that super-heated steam would be equally as efficacious, but it is impossible of application by any appliance that we as yet possess, and can never be used except in close rooms. A high local sanitary condition, and an efficient quarantine, gives us our only safety that is undoubted and reliable.

"Dr. Hicklin's notions of the measures used will strike every one as probable and almost beyond the shadow of a doubt true. Yet we must not forget the words of wisdom that came from Dr. Nott's long experience of yellow fever, 'That when he had passed through his first epidemic, he thought he was master of the natural history of yellow fever and its origin or cause. The second changed many of his preconceived notions, and after passing through many epidemics, he was left without any definite notions about its origin, or cause, and means of prevention.' We will await the further trial of local measures to arrest or prevent the spread of yellow fever, when it once gets a full hold, before we give to them our unqualified support."

WHAT TO DO AGAINST YELLOW FEVER.

By HENRY HARTSHORNE, M.D.,
Philadelphia.

WITH a practical end in view, it is my wish to consider briefly in the light of such sanitary experience as is least doubtful, and with such inference therefrom as most will agree upon, what should be the duty of municipal authorities, when yellow fever has actually broken out in a city, town, or village. Thus, the question, "How to keep yellow fever at a distance?" important as it is, is set apart as another inquiry. The case now proposed is, that in which, however originated or introduced, new cases of the disease are appearing, in persons residing in the locality, without their having visited any other place in which the infection could be present at the time.

For the population of such a place, several possibilities exist. Under the influence of panic, it might happen that the sick would be deserted, and a general stampede would occur. Or, without such desertion, a multitude of persons in health might leave the place for their own safety, while those remaining would continue their daily avocations, without much local alteration, a certain number giving their services to the sick at their homes. Some general sanitary measures, of cleansing, disinfection, etc, might also be carried out. This course appears to have been essentially that which was pursued during the late dreadful visitations at Shreveport and Memphis. Cannot something better be done, in every such case, from the very start? That is our practical question.

Facts must be appealed to upon this. Is yellow fever a disease of personal, or of local causation? Few, at this day, will assert or acknowledge that its production depends upon a material (like the small-pox virus) generated in the bodies of human beings affected with the disease. If any small minority uphold in any sense the idea of its contagiousness, they will, probably without exception, add to this opinion, the recognition of the indispensable necessity of local conditions acting with personal propagation, in order for the disease to spread, in any locality whatever. Obviously, therefore, the local conditions are the *sine quâ non*, upon either of these, the only tenable views. To my own judgment the non-communicability of yellow fever from person to person has been so well established, that I regard the consideration of any such possibility as simply hampering the inquiry, and interfering seriously with its right solution. Transportation of the disease, with its cause, by ships, is not personal communication at all. A vessel is a place; *i. e.*, it conveys an agglomeration of external massive materials, affording local conditions to human beings, such as are capable

of being carried from port to port, through hundreds of miles, without essential change. These conditions originate and reside outside of human bodies; in connection with influences belonging to climate, the earth, water, and decomposable organic matter: all of which it would be beyond the purpose of the present paper to discuss. My point is, that with a disease whose origin and propagation are personal, our sanitary measures should deal with persons; whereas, when the conditions determining and maintaining an epidemic or endemic are local, we should deal with places in its prevention, and in attempting its arrest after it has broken out.

ANALOGOUS TO A FIRE.

What follows from this? An analogy of a very close character is furnished by the instance of a conflagration. When a house or a block of houses is on fire, two things are aimed at, with the least possible delay: to remove human beings and perishable property, and to put out the fire. If I apply this comparison directly to the local prevalence of yellow fever, I am asked at once, to establish the resemblance between the two cases, by making out its capacity of limitation. My answer to this is, that yellow fever always is, in regard to its local prevalence, self-limited. Does any one deny this? Of course, there is no thought of overlooking the fact that this disease may exist at the same time in places separated from each other by many degrees of longitude as well as latitude. But these are spots of infection, apart from each other as absolutely as are islands in the sea. And the continuous areas of such infected localities are always measurable in miles or fractions of a mile; often in rods, blocks, or houses. Take the instance of the shipping infection at the New York Quarantine station in 1856; or that at the Lazaretto below Philadelphia, in 1870. Or, consider the history of one epidemic after another in Philadelphia, as notable examples. From 1699 to 1853, Dr. La Roche gives indisputable recorded evidence, in regard to the localities affected. In 1741, a letter from Mr. Peters says, "At first it crept along the wharves, affecting strangers, common sailors, and the low and poor part of the people." In 1762, "the disease was mostly circumscribed between Pine Street northerly and three or four squares southerly, and extended from Front or Water Street to Third or Fourth, in a westward direction." The remarkable epidemic of 1793, whose history was written by Dr. Rush, "making its first appearance in Water Street, between Mulberry and Sassafras . . . . it extended northwardly up Water Street to Vine. Front Street, within the above limits, was next attacked, where it spread in the parallel streets and up those running east and west. In the progress of a short time, it prevailed in most parts of the city. . . . . During the whole course of the epidemic, the greater number of cases occurred in the vicinity of the Delaware River; there, also, as in close alleys and small streets, the disease assumed its most aggravated form, and proved most usually fatal; and its severity lessened in its progress westward and to the open districts." 1794 gave the same kind of facts; — "it made its appearance in the usual localities, — prevailing in Water Street, between Market and Walnut, and extending westwardly in various direc-

tions." In 1797 again, "the disease prevailed about Pine Street wharf, in Water and Penn streets, and also, and principally, in the suburbs of Southwark and Kensington. While these spots were severely visited with the disease, the city, both along the wharves and at a distance from them, remained healthy, from Walnut to Vine streets. Some cases, it is true, occurred in the city proper in the course of September and October; but most of these were readily traced to the above sources." In 1798, "the principal seat of the disease was the river side and the adjoining streets. . . . . On this occasion, and this only, the disease penetrated into the jail, situate at the corner of Sixth and Walnut streets, and even into the Pennsylvania Hospital, in Pine, between Eighth and Ninth streets." The same account, with the exception of the last named unusual extension, is recorded of the summers of 1799, 1802, 1803, 1804. In the last of these years, "epidemically, it did not extend westwardly beyond Second Street in the city, and Fourth Street in Southwark. It was principally rife near the water side, where it assumed its most malignant garb." In 1819 exactly the same state of things occurred, although with but twenty fatal cases. 1820 was the year of an epidemic made memorable by the services and investigations of Dr. Samuel Jackson, the President of the Board of Health of Philadelphia. A table of mortality, from the records of that body, shows only nineteen cases (out of one hundred and twenty-five in all), not traceable certainly to localities near the Delaware River, — although some of these places were two miles apart in the direction of its channel and shores. To the active and judicious measures of the Board of Health, under the leading of Professor Jackson, is ascribed the moderate degree of prevalence and mortality of this epidemic; and to the important sanitary reforms then at once urged and commenced, it was no doubt chiefly due, that after that date thirty-three years elapsed, before, in 1853, even a limited visitation of yellow fever occurred in Philadelphia. In this last instance, also, the beginning was along the wharves, near South Street. "From this point," writes La Roche, "the disease extended north, south, and west, and covered a space measuring some six hundred yards in one direction and two hundred in another, and bounded north by Union Street, south by Queen Street, west by Second Street, and east by the Delaware River."

TESTIMONY AS TO ITS LIMITATIONS.

Such marked and amply authenticated facts as these are not peculiar to the occurrence of yellow fever in Philadelphia. They have been recorded over and over again elsewhere. But few cities have been so favorably situated for tracing the lines of demarkation of the infection; and, as all know, there has been no other so painstaking a historian of the disease as La Roche. Turning to the pages of another truly classical medical author, Dr. Daniel Drake, in his great work on the "Principal Diseases of the Interior Valley of North America," we find testimony to those limitations which have been referred to. This, for example, is his general statement: "The inhabitants of the country, even within a few miles of a town where the disease is epidemic, generally escape it, unless they venture within its

sphere of prevalence." In reference to New Orleans in particular, Drake quotes an earlier writer thus: "It will be seen, in reading the description of the epidemic of 1822, that excavations of the earth may be considered as one of the causes which fixed its limits." As to Mobile, Dr. Nott and others have given more details. In 1839, the first locality attacked was "at the corner of Government and Hamilton streets, and the fever spread from that point as from a focus." In 1842, "Dr. Lewis says that it was confined to the southern section of the city. No case originated north of Dauphin Street, which runs east and west, dividing the city into two halves." The following year presented an epidemic which "fell chiefly on that part of the city north of Dauphin Street, which had escaped the year before." Describing the visitation of 1843, from evidence given by Drs. Nott, Fearn, Ross, Lopez, and others, Drake observes: "The reader will observe in this narrative a perpetual recurrence to the same streets, and by turning to the map will at once see the part of the city in which the disease made its appearance, and where it prevailed for three weeks; after which, in the language of Dr. Lewis, it could be traced in a southeasterly direction until it reached the heart of the city."

It is certainly not necessary to extend these citations of facts, probably familiar to many, perhaps to all, of the members of the American Public Health Association. But I have desired to *emphasize* the distinctive nature of this localization of yellow fever, being convinced that this fact affords us the clear indication required, as to what ought to be done to antagonize the disease, and to prevent its continued ravages, when it has anywhere begun to prevail.

In attempting to come, then, to an immediately practical conclusion, I have here to refer to the judgment not only announced but carried out by Professor Jackson and the Board of Health in Philadelphia in 1820, and confirmed by the report made to the French Academy of Sciences at Paris, by M. Dupuytren, in 1825. Nor will I be deterred from such a retrospective allusion by anticipating that some one, of views different from my own, will at once attach to them the phrases "antiquated" and "obsolete." The antiquity, perhaps, may be admitted; obsoleteness, not at all. Some truths, old in themselves, are always practically new, until they are thoroughly understood and applied.

Flight from cities affected with yellow fever has, indeed, been a frequent occurrence, in many places, upon a large scale. An English Blue Book ("Second Report on Quarantine") for 1852, exemplifies this by two pages of instances; at Cadiz, Malaga, Tortosa, Barcelona, and six other localities. The value of such facts is twofold: they show the safety of leaving yellow fever behind, on the part of those who go away from the infected places, and they show also the impossibility of their taking it with them, to injure or destroy the inhabitants of those localities to which they escape. One of these examples may suffice for our purpose here. In 1821, from Barcelona, about 80,000 persons fled, and 70,000 remained in the city, during an epidemic of yellow fever. The former, except a few who left the town ill, continued exempt from the disease. Of the latter who remained, nearly 10,000, or one in seven, died.

ISOLATION OF THOSE AFFECTED.

To come to the point. In 1820, in Philadelphia, Doctor Jackson, and the large majority of the medical men of the city, proclaimed and defended the doctrine of the local infection of yellow fever; and the Board of Health acted upon it.

Ascertaining exactly the bounds of the narrow region of the city to which the origination of all the cases could be traced, they "determined not only to remove such of the sick as had not the means to procure proper attention, and whose situation permitted the change, but to clear the affected district of all its inhabitants. Those able to procure places of refuge, either in the country or in healthy parts of the city, were allowed to shift for themselves; others were provided with accommodations in one of the wings of the City Hospital. By these means, most of the houses were cleared of their inmates in a few days; fences were erected to cut off the approaches to Hodge's wharf and dock, at Race Street, which appeared to be the focus of the disease; and offensive matters were, as far as practicable, removed. These measures had the desired effect, and put a complete stop to the disease in that vicinity.[1] When the fever appeared at the foot of Walnut Street, similar measures were, at the recommendation of a number of physicians, adopted. The inhabitants of the infected district were as speedily and completely removed as circumstances would permit, and barricades were erected. There, too, the plan was successful. The disease was in great measure arrested in its progress, and limited to the very narrow space already mentioned."

Such is the brief recorded account of, probably, the first attempt at a rational method of dealing with a yellow fever epidemic. We have, now, the advantage of being able to add to it much more effective means of local disinfection than were then attainable. We may now not only rescue many victims from the seat of the conflagration (to revert to a figure before used), but also do much to put out the fire. Especially have the resources of sanitary science for this end been augmented, since the introduction, by Dr. Henry, of Manchester, in England, Dr. Von Busch, in Germany, and Dr. Elisha Harris, in this country,[2] confirmed and aided also by the observations of Dr. A. N. Bell, and others, of what I regard as the most important sanitary improvement since vaccination — the use of heat, or of superheated carbolized steam, for disinfection. But I do not need to place here emphasis upon this; although it may be believed that its application will come to be hereafter, much more fully than now, appreciated and extended. The principle which I desire especially now to maintain is, that of the immediate removal of all the inhabitants from any locality known to be the place of origin of new cases of yellow fever.

THE EVIL TO BE STAMPED OUT AT THE START.

Put out the sparks at the start of it, and thus avoid the conflagration; do not, instead, let it burn on, and gather physicians, Howard associations,

[1] La Roche on *Yellow Fever*, vol. 1, p. 107.

[2] See "Report on the Utility and Applications of Heat as a Disinfectant," by E. Harris, M. D., *Transactions Fourth National Sanitary Convention*, Boston, 1860, p. 219.

and nurses, into the midst of the flames, to bind up there the perishing victims, and martyr themselves in doing it. All this may be prevented. I do not know what may have been the expenditure of money and lives during this summer's epidemic at Memphis and Shreveport. It is said that at Memphis, between 1,500 and 2,000 out of between 12,000 and 20,000 of the population not taking flight, died; including a number of physicians. Not long since, after large and noble contributions from many places, and near the end of the visitation, it was asserted that "$50,000 more will be required to finish the work of the hospitals at Memphis." Now, suppose that only three or four times that sum has been consumed or lost to the city of Memphis (although this is no doubt very far too low an estimate) by the continued prevalence of the disease, and through its direct and indirect results. How much of this would it have required, to vacate, as soon as they were known, and then to thoroughly disinfect, each and all of the foci of that epidemic? It is to be remembered, as an important fact in considering the practicability of such measures, that yellow fever is a disease mostly of warm climates, and always of the summer season only. The cold which would render the unhousing of the poor impossible, never arrives except as the welcome cause of the termination of the occasion for such displacement. Extemporized dwellings, tents or huts, not too close together, might be provided upon the highest and most salubrious grounds outside of an infected city, for such inhabitants as were not able to take full care of themselves; and this, it must be confidently repeated, at but a small fraction of the expense which inevitably attends the persistence or extension of an epidemic of this disease.

May it not be hoped, therefore, that sanitarians will not either reject or be indifferent to this method of curtailing the ravages of the most destructive disorder native to, or naturalized upon, our continent. For a malady productive of much less alarm, although causing a very serious mortality in early life, I have shared with Dr. Toner the hope, that a similar preventive principle may before many years be applied with success in our great cities: I refer to the establishment, for the *prophylaxis* of cholera infantum, of summer camping grounds or sanitaria, for infants and their mothers, during the hottest months. This is a project worthy both of sanitary science and of philanthropy, but the arrest or prevention of epidemics of yellow fever is of yet more pressing urgency; as they prostrate the young and the old, and, in their worst visitations, interrupt, by affliction and death, the whole course of business and of social life.

VI.

THE PRINCIPLES AND PRACTICE OF QUARANTINE IN THE PORTS AND CITIES OF THE UNITED STATES, — EXPERIENCE AND REQUIREMENTS.

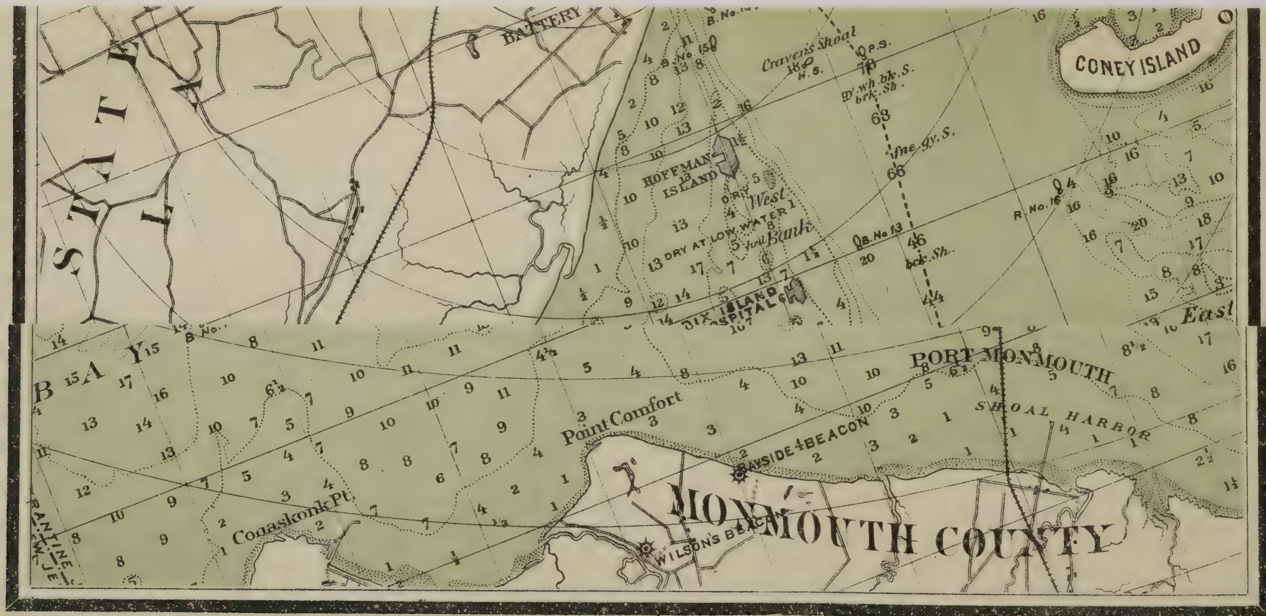
GENERAL PRINCIPLES AFFECTING THE ORGANIZATION AND PRACTICE OF QUARANTINE.

By S. OAKLEY VAN DER POEL, M. D.,
Health Officer of the Port of New York.

The consideration of the subject of quarantine is based upon the notion that there is a class of blood-poisons which are *transmissible*. It is, I believe, admitted that there are those of a strictly endemic character, dependent upon local conditions, and, with the exception of typhus fever, rarely extending beyond the influence of those conditions. With this single exception they are not *contagious*, or, to use a more fashionable term, in place of one which, since the days of Frascator, has done good service, and explained succinctly the idea intended to be conveyed, they are not *transmissible.*

There is, however, another class, which may be termed *exotic* in origin, and to prevent the importation or transmission of which, quarantine, in one form or another, was long since established. Limited both in number, and in the extent of territory in which they are indigenous, they assume a virulent and specific character, become transmissible to persons not exposed to the primary influence, and extend over vast portions of the inhabitable globe, and, after raging epidemically for a period, subside sometimes, it would seem, from mere lack of material for further ravages, or at another as if the primary germ-power had become exhausted. Coming as they do from localities outside of European or North American centres of population, their approach is always regarded with grave apprehension ; and from the earliest periods we find each country, each district, or it may be each municipality, devising restrictive measures to prevent their ingress.

The march of every affection transmissible by man is in reality subordinate to two conditions, each of which plays an important part : 1. The contagion, more or less intense, no matter what may be the vehicle. 2. Amount or degree of receptivity of the threatened population, of whom the immuni-



MONMOUTH COUNTY
PORT MONMOUTH
CONEY ISLAND
HOFFMAN ISLAND
DIX ISLAND HOSPITAL
Point Comfort
Conaskonk Pt.
WILSON'S BEACH
BAYSIDE BEACON
SHOAL HARBOR
BATTERY
Craven's Shoal
West Bank
DRY AT LOW WATER
East

QUARANTINE CHART OF NEW YORK HARBOR ACCOMPANYING THE REPORT OF DR. VANDERPOEL.
HEALTH OFFICER.
NEW JERSEY
BERGEN CO.
STATEN ISLAND
LOWER BAY
UPPER BAY
HUDSON RIVER
NEW YORK
EAST RIVER
BROOKLYN
KINGS COUNTY
QUEENS COUNTY
MONMOUTH COUNTY
CONEY ISLAND
QUARANTINE ANCHORAGE
JERSEY CITY
HOBOKEN
WEST HOBOKEN
Guttenberg
Weehawken
RICHMOND
GREAT KILLS
Bass Creek
Point Comfort
STAPLETON
TOMPKINSVILLE
FORT HAMILTON
GRAVESEND
NEW UTRECHT
WILLIAMSBURGH
LONG ISLAND CITY
GREENPOINT
ASTORIA
9400 Yds.

ties or morbid predispositions, sometimes inappreciable in their intimate cause, are, however, usually referable to the hygienic conditions of the population.

Since the end of the last century we see observers of merit protesting against the theory of contagion, and the practical results consequent upon the corrections of such theory. These would be the suppression of quarantines, the abolition of all impediments which might obstruct commerce, and the free circulation of travellers and merchandises. This is not, then, a discussion purely scientific, which amuses only cultivated intellects, having little practical results; on the contrary, an affirmative or negative solution would, on the one hand, paralyze all efforts, or, on the other, impress upon them a determinate course. For, if the origin of epidemics is to be ascribed to cosmic, telluric, or individual causes, over which we cannot hope to exercise any influence, we must be resigned to them, and endure them with the same patience that we do the summer heats or winter storms. This idea finds a practical application in the respective measures taken by England and France with reference to the cattle-plague. Breaking out as it did about the same time in both countries, the resultant effect of different action is readily noted. The French veterinary officers, convinced of its contagious character, took immediately the most vigorous measures to strike at the root of the evil. It was necessary to slaughter promptly about a hundred animals to put a stop to the progress of the epidemic. In England, antagonistic opinions combined with imperfect legislation allowed matters to follow their natural course. The result was, that three hundred thousand animals died from the disease.

It is, then, of the highest importance to have decided opinions upon the subject: to wait until an epidemic is upon us, is to wait for precautionary measures after our building has been fired. Individual facts have more than once shown that the arrival of a single sick person in a locality, up to that time intact, has developed the epidemic. It is the initial case in which lies the chief danger; nor can I recall a better illustration of this than the facts presented by Dr. Peters in his researches upon the cholera in Lexington, Kentucky, during the past summer. Thirteen deaths occurred, before that of the initial case, every one of which was traceable to causes emanating from that case. I may mention here as at least a recognized fact, that all epidemics follow the routes, and with the same celerity as those who travel upon them.

On these points it will at least be found that clinical observation, international hygiene, and direct experiment, are in full accord with the teachings of traditional medicine.

With this preliminary statement, I proceed to a more systematic discussion of the subject.

1. All restrictive measures, isolation, quarantine, or, as organized in parts of Europe, the "cordon sanitaire," have exclusively as their purpose, often indeed at the expense of human liberty, to trammel the propagation of the morbid cause. Local hygienic measures are intended to render a district, so to speak, refractory to the action of this cause, by not presenting the mate-

rials favorable to such propagation. Unfortunately, these two courses have been, on the part of some, considered as two distinct methods, antagonistic the one to the other. The first, that is, restriction, has been extolled beyond measure by the contagionists, as sufficient. They only see, in every epidemic propagation, a series of morbid acts, fatally imposed on many similar organisms by the contact of a specific germ. The second, the pure hygienist, is the device of the partisans of morbid spontaneity, of the anti-contagionists, who, not content to recognize the enormous influence which the local conditions possess upon the germ, forget that we often see epidemics propagated in most salubrious localities, and consequently that we must oppose to transmissible affections other obstacles than those ordinarily included in mere hygienic principles, which alone can never confer upon the masses of a population an immunity comparable to that of lessening or rather excluding the cause. Each system errs in creating an exclusivism, because first, the method of absolute restrictions is contrary to the dignity of man, by the frequency and the abuse of the sequestration which it imposes. It is contrary also to the well-being and health of a people, to neglect to guard against the dangers which arise from collections of filth, the true local nests of every infection. Yet to-day we see this neglect exemplified in all the Spanish, Italian, and many eastern ports, where thorough cleanliness constitutes the only safeguard in times of great epidemics. We know full well that, in most of these countries, the moral wretchedness of the people equals their physical, that above all else they are blindly superstitious, and attach themselves to measures of quarantine sequestration with the fanaticism characteristic of all their other beliefs, and are ready at the first indication to sustain them by the most violent and unreasonable acts.

2. The method of local prevention by rendering healthy the threatened locality, by ameliorating all the social conditions of the inhabitants, is, in itself alone, more specially adopted by a civilized people. It has this immense advantage, of inaugurating and establishing for a community an era of comfort and prosperity. You are all aware how much England owes to her immense works, undertaken, upon hygienic bases, within the past ten years. Thanks to these labors — thanks, also, to her natural isolation from the continental masses; still more, thanks to certain climatic conditions — Great Britain can, with impunity, maintain the free *pratique* of her ports. To attribute her immunity against different pestilential diseases to the happy effects of hygienic measures, is to encourage every nation or community with whom the principles of hygiene have not yet become practical; but in so doing, only one of the reasons of this immunity is recognized: the importance of climatic and topographic influences upon the march of epidemics is forgotten. In France, where public hygiene has made great progress — in this country, which will soon surpass, in this respect, the civilized world — owing to the special conditions of geography and climate, it is necessary to adopt, against the propagation of epidemics, a more complete system of prevention. They must first obstruct, by restrictive measures, the propagation of the morbid germ; and, secondly, render, as far as possible, each locality refractory to its development. In

both France and this country we have the daily proof that the two methods, in place of mutual exclusion, should be combined, in order to unite the double base of international and municipal prevention. So far from opposing each other, these methods mutually complete a system; and now, at this port, the system of quarantine embraces the whole series of prophylactic measures opposed to the propagation of epidemic diseases, it matters not whether the measures have for object the opposing of the transmission of the morbid germ, or whether only to hinder its development by hygienic labors. From this happy accord results a sanitary *régime* more complete and more rational, and where we can, according to circumstances, apply the one or the other element. Quarantine restrictions, so senseless and imperfect heretofore, have drawn from prophylactic hygiene the fundamental principles of their actual working.

The truth is, the question of quarantines is one of the most complex of hygiene and medicine. If you bear in mind the obscurity which still hangs over the conditions of the development of epidemics; if you recall that, upon the globe, there is not a continent — that, on such a continent, there is not a country — which does not present different conditions of predisposition, or immunity, with reference to these scourges; if, further, it is remembered that every quarantine system, while it confers advantages upon those it protects, involves grave prejudices for those it contravenes, you will understand how difficult it is to express, in determinate administrative formulas, regulations applicable to every place. The joint responsibility so necessary among localities, since the most rational or the most absolute measures undertaken in one country can be rendered nugatory in their results by the indifference of another, will, for a long time, be difficult to obtain. To be scientific and practical, they should necessarily arrive at conclusions variable according to the locality or port to which the regulations are to be applied; variable, also, according to the nature of the diseases they propose to contravene. These regulations will then, by their diversity, recall how varied are the dangers they should prevent, and also how different is the morbid receptivity of the different populations which they are to protect. It is not difficult, then, to comprehend how essential it is that the great question of sanitary measures should become more and more the privilege of competent men — of men who understand the mode of propagation of epidemics, the local and geographical conditions of their development, and the special prophylactic measures applicable to each.

Rules established by tradition and custom have, without doubt, thanks to their uniformity, great facility in their practical application. But always to impose the same rules, in the most diverse conditions of time and place, as well as the nature of the epidemic designed to arrest, would be to act contrary to all our scientific data. Too long has this reform been retarded by the traditional errors drawn from European regulations, and we have, in this country, the opportunity to disembarrass ourselves from a host of practices inspired by secular prejudices common in Europe.

While, then, true prudence should cause us to abstain from bringing the same regulations to the prevention of all pestilential diseases, the forms and

modes of propagation of which vary so wholly, according to the places in which they are observed, we are not so embarrassed in determining the nature of the establishment required. Sanitary establishments have to-day their types, indicated by physicians and hygienists — types which can be reproduced and, as occasion requires, perfected. Not so, however, the regulations. We cannot give to all ports the same mode of application. In one city there may be topographical or social conditions which modify the degree of morbid susceptibility in the different classes of the population. In fine, no absolute, no arbitary rules can be formed, suitable for every latitude, every clime, or every people.

There is still another class of influences, irrespective of locality and the different forms of the pestilential diseases. They are the particular features of the epidemic itself, so variable at each explosion. When, for instance, we see one of these affections cover, so to speak, the entire world and its manifestations, or, at another time, as a circumscribed epidemic — when, in following out their history through a course of centuries, we see, at one time, the plague, at another, cholera, or again, yellow fever, play successively the principal part in the scourges which decimate populations — we are certainly compelled to recognize the variability of the conditions of development of epidemic diseases, and consequently the inequality in the character of the protective measures.

It seems to me, we shall best appreciate the different bearings of this subject by tracing, for a few moments, the origin and progress of the principle stated, and which controls the administration of this branch of sanitary science. The idea of the transmission of diseases by contact is one which dates back to the farthest antiquity. The minute prescriptions by which Moses sought to isolate, even in the midst of his camp, those attacked with leprosy, or other diseases which he supposed contagious, would indicate that already, by the ancient Egyptians, this first notion had been universally accepted.

Still the first account we have of an epidemic propagated from *contagion* is not by a physician, but by the historian Thucydides. The plague at Athens is the first known of these formidable affections which, coming from without, fall suddenly upon an entire population, snatching innumerable victims. In the march of this epidemic we find the principal characteristics which at different times have been met in all subsequent incursions. Overcrowding, wretchedness, hunger, were shown among the predisposing causes which ever since have been known to favor the development of these fearful scourges. The fact, too, was established, that its way of entry was by the *sea*, the chief route for epidemics to enter a country.

It was not, however, until the appearance of the plague in 1348–50, that the *régime* of quarantine against pestilential affections was fully inaugurated. As for ages previous leprosy had been the principal disease for which isolation was ordered, we see, in looking over the regulations which existed in many places on the shores of the Mediterranean, that they were those adopted with regard to leprosy, save that the definitive isolation of the one was changed to the temporary sequestration of the other. About this

period the recurrence of grave pestilential epidemics inspired the public, rather than physicians, with the notion of their transmissibility by those attacked. As a consequence the restrictions were marked by the brutal and superstitious spirit which characterized the age. The murdering of physicians, the bloody persecutions against the Jews, self-imposed tortures by individuals to propitiate Divine mercy, give evidence of the superstition and barbarity of the epoch.

Soon it was noticed that vessels and passengers coming from the East, though not attacked themselves, brought with them the morbid germ. Venice, rising from her lagoons, was then the most enterprising and chief commercial city of the world. Covering the Mediterranean with her vessels, she engaged in the same time in commerce and in war; consequently, her port more than any other was subject not only to the black plague, but especially the Egyptian, then so frequent in its explosions. Induced by their frequent appearance, she proscribed the sale and destroyed the effects of those who had died. She created three protectors of the health, a health bureau, and finally a lazaretto, which subsequently formed the model for all other ports.

To one familiar with the history of the subject, it is interesting to study the minute distinctions made not only with reference to the bill of health, but the measures of observation taken with reference to passengers and merchandise — measures which, while they might protect the community, ignored entirely the rights and privileges of those suspected; and which, were there the least trace of fomites in the vessel or cargo, would be certain to communicate it to the poor unfortunates, who were compelled to undergo an almost unlimited period of observation. During the latter part of this century observations were more carefully and systematically instituted, and the modes of propagation of the scourge more accurately noted.

During the early part of the present century, the doctrine of quarantine was affirmed with renewed energy, and the privileges accorded were, if possible, more decided; gradually, a more exact appreciation of facts induced a more eclectic tendency, preserving that which was useful, and rejecting that which was exaggerated. We notice, too, in European governments the first steps taken to stifle pestilential maladies in their place of origin, which resulted in the international congress to consult upon the principles to be laid down in order to prevent their wide-spread diffusion.

An additional interest arises in their study, from the modification of the list of diseases to which restrictive measures should be applied. Up to the commencement of this century, no other disease than the plague had occupied the attention of quarantines. From 1821, however, the interest in this disease gradually subsided, to be replaced, in a far greater degree, by the questions of yellow fever and cholera. During the few years previous to this the anti-contagionists had protested strenuously against all restrictive measures in yellow fever, asserting that it could not be imported, and that those who thus affirmed were men without experience, obstinate, and of limited information. Scarcely had these positive opinions been enunciated, and even obtained some credence in public sentiment, when the

terrible scourge of yellow fever, which invaded Barcelona in 1821, appeared. Its transmission by sea was undeniable; reaching the quarantine of Marseilles, it was excluded from that city.

For the cholera a different order of circumstances presented. The danger to be apprehended here was not from the side of the sea, but from the land. For years European governments had watched the progress of the Indian scourge, the terror inspired by its ravages in Asia, and had hoped to arrest its progress on the Russian frontier. It was thought that, by creating a "*cordon sanitaire*" on the boundaries of each country, its progress could be arrested. Various restrictions to intercourse were established, virtually establishing quarantines by land as well as by sea. We all know how useless were these efforts. The rapid march of the first cholera epidemic through Europe in 1831, and the fact that it did not appear in certain countries where no restrictive measures were applied, showed the utter uselessness of these *cordons sanitaires* in thickly settled districts, and they were soon abandoned. It had the effect to revive the old discussions relative to its transmissibility from man to man, many asserting that it was wholly epidemic in its character, an argument which had a specious force from the rapidity and uncontrollability of its progress. Its contagion was treated by them as a chimerical belief; those who opposed the idea of contagion were considered truly men of progress, since they opposed restrictions to personal liberty, and their views were applied, not only to cholera, but typhus and other diseases. These hesitations and differences continue more or less still among the different portions of Europe. Indeed, the futility of the effort to establish a uniform system of quarantine regulations for countries or sea-ports in different localities, having different relations with countries from which malignant diseases are brought, is acknowledged there — that which experience had long ago taught in this country.

Matters remained very much in this unsettled state, both as to the principles which should govern the administration of quarantines, and the varied action of different governments, when, in 1850, a convention, with reference to some uniformity of principle, was held at Paris.

It consisted of representatives from all the principal European powers. They were medical men, and with them were associated also the consuls of the respective countries represented in France. Discussions of a purely scientific character were ignored; confining themselves to facts generally accepted, and by the aid of mutual concessions, they arrived at a code of international sanitary regulations, which, though since modified in many particulars, have remained the basis of all subsequent quarantine legislation. Among them I find many of the provisions of the law now in force in this State. I cannot enter into an analysis of its provisions, but whoever reads it carefully will see that it is based upon a study of the cause and progress of the diseases which it is intended to intercept, and, almost for the first time, places the administration of these establishments in the hands of medical men. It is not inappropriate to quote an extract from a paper by the Minister of Agriculture and Commerce, written just before

this convention. He writes : "The question of quarantine is one of those questions of public hygiene which the government cannot decide, and which can only be resolved, either by the Academy of Medicine, or the Academy of Sciences."

The spirit inspired by this convention awakened a new interest and enthusiasm on the subject, and was the initiative to the subsequent gathering at Constantinople some fifteen years later. An energetic impulse was given, not only to the study of restrictive measures, but the still more important duty, the application of public hygiene to the prevention of epidemics, if possible, at the source — to stifle them in their exotic cradles, or, at home, in removing the causes by which they are propagated, thus each diminishing the zones over which they can spread.

In looking over quarantine legislation as enacted at different times in this State, we are first struck with the freedom from the trammels and prejudices and formalities which so long marked all European enactments. Each principle seemed to spring from the practical necessity of the occasion, and was generally the result of the experience afforded by some epidemic of fever just passed.

The first legislation was in 1784, and compares most favorably with contemporaneous European enactments. Yellow fever was then a frequent visitant at this port, appearing as an epidemic nearly every year during the latter part of the last and the early years of the present century. Another principle, as the result of these repeated epidemics, was early established, namely, that all vessels from foreign ports, and all coasting vessels, coming from south of Cape May at certain seasons of the year, should undergo sanitary inspection on entering the port. It is evident that the natural history of yellow fever was not fully understood, or we should have no such clause as this : "Vessels to be detained thirty days at quarantine, and twenty days after discharge of cargo. Cargoes to be detained subject to the decision of the health-officer. Crews and passengers to be detained twenty days after the last case of yellow fever, or twenty days after sailing from an infected port." What would become of West India trade if such orders were now enforced ? Yet a provision, containing almost similar regulations, stands now in force upon the statute-book. The whole tenor, however, of legislation has been to recognize the opinions and decisions of medical men in the quarantine enactments ; and, as a rule, they reflect the current opinions of the mode of dissemination of the epidemics they were intended to contravene. It is not necessary in this connection to recount the present practice with regard to pestilential diseases. I need only say in passing, that, as now constituted, the establishment is most complete in all its appointments, and fully equal to the sanitary requirements of the times. For the present there are still a few general considerations connected with the subject to notice before proceeding to the study of the special diseases.

We are now prepared after a very hasty historical sketch of the origin and growth of the systems of quarantine, to consider their *prophylactic* value. I am aware of the varied opinions which exist on this point, both

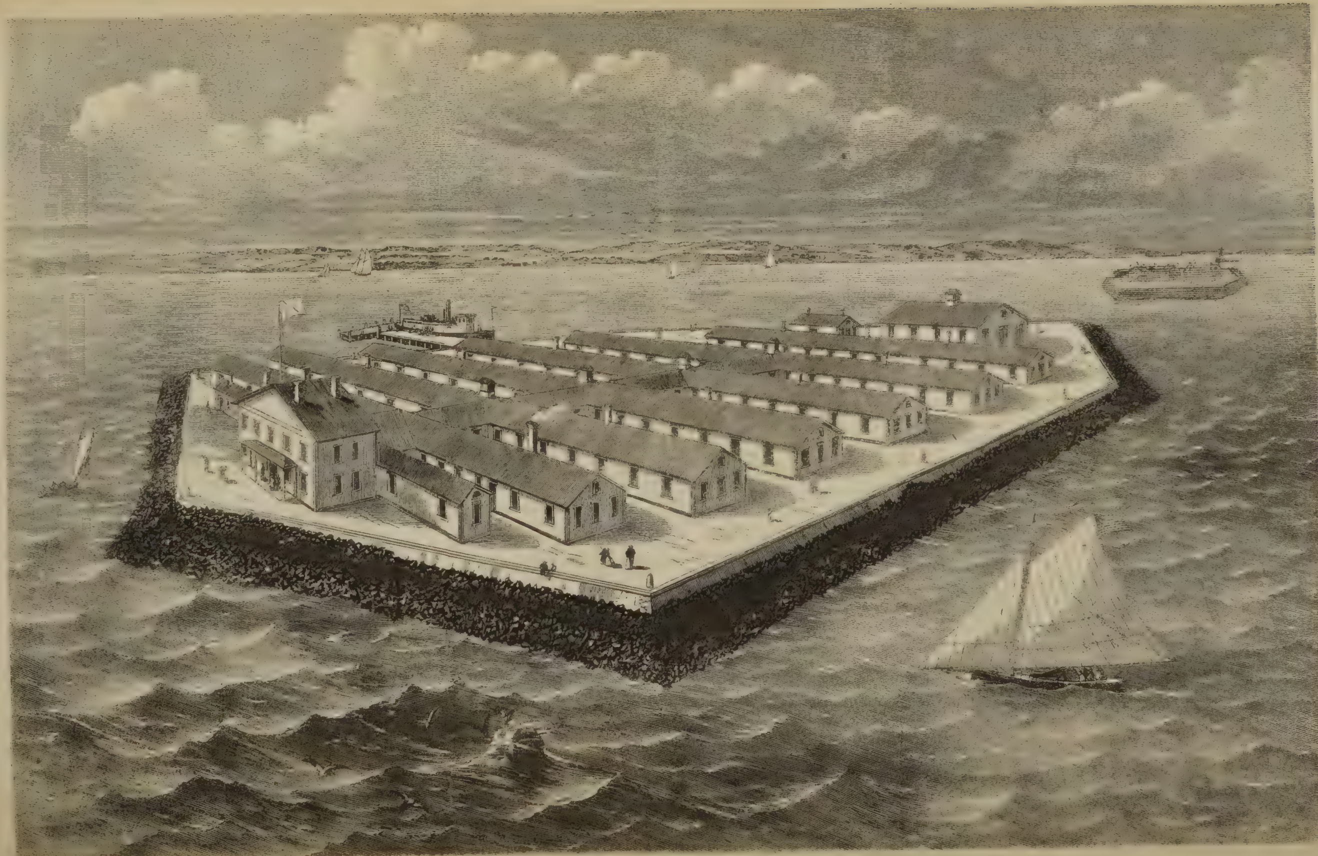
in this country and in Europe, of partisans who on the one hand deny all sanitary value to their restrictions, and of those on the other, who claim for them exaggerated benefits. On looking closer at the school which opposes all sequestration, I find, almost invariably, that their opinions are formed and based upon the surroundings and climate of their *particular locality* — surroundings where, from the nature of their relations to neighboring countries, no restrictive measures, save those which could be effected by a *cordon sanitaire* (a system found totally inefficient in thickly populated countries, and only applicable in sparsely-settled districts), could be applied; and, on the other hand, countries situated in latitudes where the exotic pestilences, all of which find their endemic dwelling in the torrid zone, can, with the exception of cholera, find but a short season when temperature and hygrometric conditions would favor their development.

Such persons, studying from their own stand-point alone, attempt to apply general principles to all localities: a fallacy too absurd for contradiction. Quarantines are not essential to the higher regions of the temperate zone, nor to the localities in the torrid, where climate and temperature readily make yellow fever and cholera endemic. Strange as it may seem, there are still partisans who have their objections, upon the blind belief that there is a mysterious, intangible principle in the propagation of epidemics, and so deny the benefits of preventive measures.

The question naturally arises, how far is sequestration advisable against exotic contagious diseases.

This sequestration is only advisable in localities where a general supervision of the arrival of such diseases is *easily made*, and which are separated, so to speak, by a natural zone of isolation from suspected districts. Such are localities on islands or cities, where the entrance of the disease would be almost wholly by sea. In such places the necessary *régime* is easy of application. This is shown by the almost total immunity which this city enjoys from yellow fever, for not a season passes, but numerous cases are taken off of vessels and detained in the quarantine hospital. During the cholera of 1865, many islands of the Mediterranean enjoyed an entire immunity from the disease. On the other hand, where topographical conditions are less favorable, this isolation from contagious diseases is almost impossible, and consequently it is illogical to impose such conditions upon them.

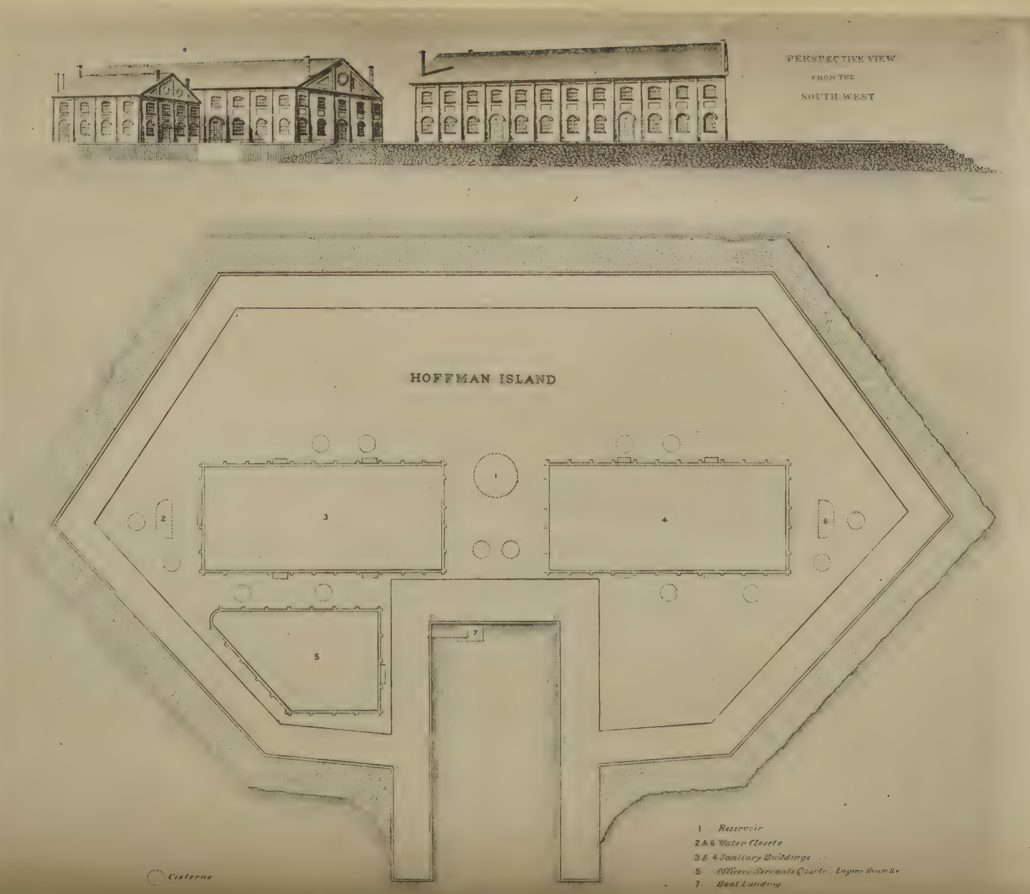
Still another series of conditions would modify the application of these measures. Such are countries situate in the endemic zone of the disease which it is desired to restrain. Before deciding, then, upon its application for any given locality, we must determine whether it does not already exist there; it may be in complete evolution, or as a localized germ. To apply restrictive measures without first determining these facts, is to establish useless barriers, and renew under another form one of the principal abuses of the old system. The limits of this zone of endemicity are often difficult to decide, still a solution so far as yellow fever is concerned has been reached. The establishment of quarantines along our southern seaboard has shown that its endemicity scarcely reaches our shores: in other words,



DIX ISLAND HOSPITAL

Staten Island in the distance

HOFFMAN ISLAND


PERSPECTIVE VIEW
FROM THE
SOUTH WEST
HOFFMAN ISLAND
1
2
3
4
5
6
7
1 Reservoir
2 & 6 Water Closets
3 & 4 Sanitary Buildings
5 Officers' Servants Quarters, Engine House &c.
7. Boat Landing
Cisterns

that, with the exception of a *small portion* of our southern coast, the disease is *exotic.* Still another set of conditions neutralizes the benefit of restrictive measures ? Certain countries are too distant from the seats of pestilence, or enjoy climatic conditions so peculiar, that these affections rarely find a lodgment. Take, for example, England : for the past two centuries her ports, relatively to the other ports of Europe, offer a remarkable immunity, when we take into account the extent of her commercial relations, against pestilential diseases. Shall we, then, say that the system of free *pratique*, which prevails in England, should be employed on the Continent ? Her immunity from yellow fever is the natural condition of her climate : this malady, while severe on the coasts of Spain and Portugal, is naturally mitigated as we ascend the Atlantic coast, until in England it finds a temperature wholly unsuited to its development. The same argument applies to the cities farther north than this on our coast.

Shall we, then, in the presence of such marked differences, arising from topographical conditions, proclaim the complete inutility of quarantines, even in localities in which, at the moment of danger, every avenue cannot be guarded ? The transmission of epidemics through channels of human communications is too capricious to guard every avenue and manner of contact. All know, however, the special susceptibility of seaports, the guarding of which should be one of the principal preoccupations of the sanitary authorities in time of epidemic. If we cannot absolutely stop every method of penetration, we diminish, to a great degree, the chances, and preserve intact our commercial centre.

The port of New York, regarded in this aspect, presents peculiarities which require a moment's consideration, not with reference to her position to the yellow fever zone, from which, since the use of steam transit, the passage is made within the period of incubation of that disease, and where, without a supervising control, the infection is liable, during certain months of the year, to be brought into the city, but rather to the peculiar feature presented by the *emigration* to this port. Nearly four hundred thousand persons, cabin and steerage, enter annually, not from a single port, or the inhabitants of a particular nationality, but from every country, and every principal seaport of Europe. It is thus in an especial manner liable to the incursion of epidemics raging in any portion of Europe, and experience has shown that their influence is conveyed to New York easier than to England. A large emigration of Poles, Finns, and Wallachians, is taking place, and, as they come from the direct neighborhood, where cholera enters Europe, and where it has been more or less epidemic for the past five years, it imposes a constant vigilance upon the sanitary condition of those coming from such countries. These emigrants are lacking, too, in even the ordinary habits of cleanliness which characterize those from the more western portions of Europe ; wearing whole suits of leather, it may be for months in succession, the clothing becomes in an especial manner easily contaminated, and, when so, impossible to purify. The limits of a paper will not permit a recital of the practices which govern the inspection of these vessels, for it covers not only the prophylactic measures involved

in the principle of quarantine, but also the general hygienic regulations which pertain to the comfort and well-being of the steerage passengers. Indeed, the functions of the department are now extended to everything which pertains to their hygienic condition; so that, while the community, on the one hand, is protected, the passengers are maintained as cleanly as the crowded quarters permit, and a system of aëration and a frequent sending on deck is enforced.

It may be asked, "Are not the ports from which these emigrants sail equally exposed as this port?" We answer, Decidedly not; they seldom receive from sea any of the passengers which they send to us under such crowded conditions. The emigrants reach those ports in small parties, by rail or otherwise, and it is only when a thousand to fifteen hundred are crowded in a limited space that the germs of contagious disease spread with such fearful violence. On land a single case may be promptly isolated; not so, however, on shipboard. Isolation and sequestration are almost impossible, while all concomitant influences, such as confined air, filth, bilge-water, and dirty clothing, are so many fostering influences for the germ.

If the general principles we have expressed are correct, it will not be difficult to make the particular application, not only to any given locality, but also with reference to the particular disease it is desired to contravene. Such application must be founded upon the natural history, the manner of transmission, and the period of incubation of the disease, and, in shaping restrictive measures, all incidental circumstances must be borne in mind. Whenever rational hygienic measures are faithfully pursued, not only at the source of the infection, but also on vessels in transit, it should be a powerful modifying element, in the restrictions applied to passengers, cargo, or vessel, on their arrival in port.

THE TRANSMISSIBILITY OF YELLOW FEVER AND CHOLERA IN THEIR RELATIONS TO QUARANTINE.

YELLOW FEVER. — Yellow fever is a transmissible disease, its place of origin being, probably, certain of the West India islands and portions of the shores of the Gulf of Mexico. Its prominent characteristics are: a feeble condition, vomiting of black matters, hemorrhages, and a yellow coloration of the skin, more or less constant, but which is usually most marked *after* death. The enumeration of symptoms indicates, at first sight, a general disease — an intoxication produced by a specific principle — which extends its action to the whole economy. It does not always present the same intensity. While usually assuming the severe form, we may have also merely outline or typical cases, which, to the sanitarian, are as much to be dreaded as the more decided. These half-sick often deceive the most rigid scrutiny; yet they possess the same specific element as the graver kind, and, in point of contagion, the same danger. Quite as much as the lighter forms of scarlet fever or small-pox convey the specific germ, so do these outlined cases of yellow fever.

It is not necessary, in this connection, to enumerate the epidemics of yellow fever, even along the different cities of the Atlantic coast. It has

appeared as far north as Boston, nearly two hundred years since, followed by several outbreaks during the latter part of the eighteenth century; while, in New York, during the last century and the early years of the present, it was marked by several epidemic appearances. It has become a yearly visitor at the port — not a summer passing but from twenty to sixty cases are treated at the quarantine hospitals.

Yellow fever can, so far as the greater part of the shores of the United States are concerned, be termed an *exotic disease.* When and where are the precise spots of its origin will probably never be known. It is never shown on our shores except by importation. Once introduced, it may develop and propagate, but never spontaneously. Limited as seems originally to have been the extent of territory from which it could claim origin, that territory has, through human intercourse, been very greatly extended; and there are now few places in the tropical and semi-tropical coasts of the Atlantic but what may be termed starting-points for the spread of the pestilence. In this connection it should be noted that, while the disease has been known on the Atlantic coast for over two centuries, it is only within the past thirty years, or thereabouts, that its appearance has been established on the coast of the Pacific. This, in part, may be accounted for by the difficulty of transmitting it, even in the hold of the ship, around the cold and wintry climate of Cape Horn; but also by another principle, scarcely less potent — the difference in the telluric aspect of the two coasts, the one offering conditions for a permanent *nidus*, the other wholly different. Much of the tropical and semi-tropical coast on the eastern shore of the continent is low, flat — through which large rivers pass slowly and sinuously — and is eminently unhealthy. The western slope, formed through most of its extent by the chain of Cordilleras, presents a far less favorable field for development.

The special sources from which the fever emanates are those marked by paludal conditions. An alluvial soil, scooped or argillaceous; inundated, periodically, by long rains; covered or bordered by mangroves; channels with mixed salt and fresh water; pools of brackish water, or lagoons, formed at the mouth of the tortuous, sluggish river; these, and other paludal conditions — such as exuberance of decaying vegetation, subsoil infiltration — mark the immediate spots from which the fever may propagate. Yet, even here, let me recall a remark made when speaking on the general subject of malaria: that, with its paludal origin, it is not necessary to suppose that there is an identity of cause between yellow fever and the forms of malarial disease. The two diseases have been repeatedly shown to exist simultaneously. The one is transmissible — the other is not; and, again, many countries, many localities exist which generate a deadly paludal but no yellow fever. We may say that the germ of yellow fever appears to be of an organic, miasmatic nature — whether vegetable or animal cannot be affirmed — coming from endemic localities. These localities are exclusively found either on the borders of the sea or at the mouths of rivers, often in common with paludal fevers proper, but differing from the latter in power of transportation for great distances, and preserving for a long time, without alteration, its reproductive germ.

Recognizing, then, the telluric influence in the origin of yellow fever, there are certain local conditions which favor its propagation when transplanted. First, its ravages are chiefly confined to low countries. Dr. Tower, after a careful analysis of all the localities in which it has prevailed in this country, finds none as high as five hundred feet above tide-water. Again, density of population is another element; it seldom assuming an epidemic form in localities containing less than five thousand inhabitants. Humidity of the soil also exercises an influence. Soil saturated with water will preserve the disease-germ. In this respect it presents a notable analogy to cholera. As with cholera, too, the social and hygienic conditions of a people exercise a marked influence in its propagation. It attains its greatest malignity among the filthy and impoverished, particularly if, as generally occurs, these reside in the low and ill-drained localities of any city. A word should be said relative to the acclimation of individuals. The general impression is, that the residents of tropical latitudes are, to a great degree, exempt, its ravages being confined to strangers or those unacclimated. This is, however, the case only when the disease is endemic. Let it appear for the first time in any tropical regions, and natives are quite as liable to fall its victims as any other class. Acclimation, therefore, is only to those who have passed a preceding epidemic period, without having left the country, and who must have been more or less impregnated with the yellow-fever germ. As the germ of yellow fever is, of necessity, transported from locality to locality chiefly by vessels, either engaged in commerce or war, it becomes, to the sanitarian, a question of the first importance to determine whether the fever can develop spontaneously upon the ship. If its spontaneity is possible, then sanitary measures and precautions should not be restricted to vessels coming from ports where the fever is known to exist, but to every vessel, in bad hygienic condition, traversing tropical regions. The opinion of physicians of extended experience is unanimous against the hypothesis of spontaneous generation. If it were possible, how is it that it never appears in vessels from China or India — vessels which, from the length of the voyage, and the long exposure to tropical heats, would seem to be in external conditions to favor the development? While, therefore, the vessel may not create the specific cause, it may become a powerful agent for the concentration of the poison, independent, indeed, of the crew themselves. This power resides in the interior arrangements, in the stowage of the hold, in the material and character of the cargo. We frequently see, on shipboard, the disease reappear if it has ceased, or become exasperated if already present, should some change be effected in the stowage, no matter in what part of the ship this occurs. This persistence of infectious causes on shipboard is so remarkable, that sometimes, after the unloading of the cargo, even for months, if the vessel is not thoroughly purified, every one entering the vessel is at once taken sick. While practically this cleansing on board of vessels engaged purely in commercial pursuits is easily and promptly effected, it becomes a very serious problem upon vessels of war. The more intricate construction of the latter, the difficulty of reaching the innermost parts of the vessels, render thorough purification almost impossible. Dr. Bell of Brooklyn, for some years

a medical officer in the navy, has informed me that some of our vessels of war, once infected, could never enter a tropical region, no matter whether the disease existed at the particular point or not, but that the fever would reappear on the vessel; that, too, although the vessel in the mean time had spent a year in cold latitudes, without showing the least suspicion that the fever-germs lurked on board. It is this tenacity of the poison to the ship, which induced the hypothesis of spontaneous generation. It would rather be a powerful consideration that there was a living, vital germ, of remarkable tenacity whenever a favorite *nidus* for lodgment was presented. It becomes magazined in the hold and sides of the vessels.

While to certain ports on this continent the question of transmission of yellow fever might, with some show of probability, be questioned, yet, when we have innumerable well-authenticated and observed instances of its transmission to European ports, and many of the more northern on this continent, it would seem that point required no extended discussion, and it remains only for us to determine the modes and manner of the transmission. Probably, in the literature of yellow fever, the features of no one epidemic have been more carefully studied, and the surrounding circumstances more carefully noted, than in that which occurred in St. Nazaire, France, in 1861. Situate entirely beyond the yellow fever zone, in 40° of north latitude, there was no danger of confounding the disease, or mistaking the modes of transmission. Every circumstance was most carefully noted from the very inception of the epidemic, by an expert commissioner, on the part of the government. In the statements now made, therefore, many will be drawn from the study of that epidemic, without necessary allusion each time to the source. I may state that experience at this port, and all the other writings I have consulted, fully corroborate the statements advanced.

We have seen that the germ of yellow fever, having its initial point on the borders of the sea, or at the mouths of maritime rivers, in a comparatively restricted part of the equatorial regions, may leave these regions; during transit it may be its presence is manifested, by the appearance of sickness among the crew; then, on the arrival of the vessel, we see during and after its discharge, a series of accidents, which, starting from a common source, go on to multiply, forming thus the starting-point of the many epidemics of yellow fever. We must now examine closer into the mode of this transmission, to determine whether the vessel, the cargo, or the crew and passengers are the agents.

In the vessel the preponderating influence belongs to the *hold;* there is a confined atmosphere, in which the morbific germ goes on concentrating, and which, when the hatchways are open, allows the disease to appear, destroying those who come within its influence, even at distances of several rods. Those necessarily most exposed are the stevedores, who work in the hold, unloading the cargo, and the coopers who repair the broken packages. The water of the bilge is also a favorite lodgment for the germ. If, in the purification of a vessel, this is overlooked, the disease, if once present, will almost certainly reappear. Certain cargoes or articles will transmit the germ, but their influence is secondary to the *hold of the ship* itself, and are

usually harmless unless the hold is already surcharged, so to speak, with poison. It may also be transported in the clothing of passengers and dunnage of sailors. It is not, however, directly contagious from person to person. In the five years during which Dix Island has been used as a hospital for this disease, not a case has appeared among the attendants, or the residents of the island. Of course, precautionary means are taken, the details of which will be given when we speak of prophylactic measures. In this respect it stands in striking contrast to cholera. The one is transmitted by influences entirely outside the individual himself, the other by influences arising directly from the person affected. To apply botanical terms, the one is exogenous, the other endogenous. The pernicious influence is exerted not only upon those who are immersed in the infected atmosphere, but the poison may be carried by currents of air for greater or lesser distances, and, if the exposure be sufficiently long, affects those thus subjected. It can be distinctly traced for over a thousand feet.

Some practical points remain for us still to determine: (1.) The incubation — upon the decision of this must depend the length of quarantine observation. The result of many observations has fixed the duration between two and six days; most ordinarily *three* or *four* days. (2.) Having considered the origin of yellow fever, the extent of territory in which it has been acclimated, the manner of its propagation, and the duration of incubation, we are prepared to consider the necessary prophylactic measures.

I. Measures to be taken at the port at which the epidemic prevails. Directly, we have no control of measures to be applied there — indirectly, our influence is felt, for the facility afforded to those who employ proper precautions warrants them in following the suggestions given.

As filth is the almost necessary *nidus* for this as well as all contagious germs, the utmost cleanliness on the part of the vessel, and the persons of the crew, should be enforced. While the vessel is in port the bilge should be pumped out daily, and often sea-water pumped in until the water pumped out is clear. After the men have finished their day's work, have them take a bath and put on clean flannels, and do not allow them to lie upon the open deck; wherever there is a poop-cabin, so much the better. If the bodies are cleaned, and clean flannel used, all the animal effluvia and sweat which remain on the surface are got rid of; these are found to be a *nidus* for the germ. Still one more measure experience has told is beneficial. It has been found that sailors, whose bowels are kept a little active while in port, are less liable to take the fever, and if they do the attack is less severe.

II. Transit of the vessel to this port. The hatches are to be kept open and the hold freely ventilated, whenever the weather will permit. It is in confined air that the virulence of the poison is concentrated. The bilge-water should be daily changed. On arrival at port, the duration of the traverse is first noted. If no sickness has occurred, and the passage has occupied more than six days, the crews, after thoroughly airing their dunnage, and submitting it to fumigation, are discharged. It may be noted that the crews seldom take any part in unloading the vessel. Careful in-

spection of the cleanliness, as far as can be, is made by the inspecting physician. The hatches and all possible openings are kept open for twenty-four hours in the lower bay, so that the strong air which usually prevails there shall permeate every part; everything is then closed tight, and fumigation, as thorough as can be, is made in all parts of the vessel. Arrived at the lighterage-station, the discharge is commenced at the earliest moment; there is absolutely no quarantine of detention; for, if there be fomites on board, the longer it is allowed to remain in the hold and bilge, the more virulent it becomes: a little leaven leavens the whole lump. Here, so far as the cargo is concerned, fresh air is wholly relied on. The raising of the cargo on deck in the open bay, passing it to the deck of an open lighter, where it lies several hours for free aëration, carrying it some miles across the bay to a warehouse, so diffuse any fomites, that, in the two summers' experience I have had, not a case of sickness has arisen from this source, and that, too, on very many vessels bringing sickness into port.

Fumigation is daily practiced upon the vessel during the unloading. This discharge of cargo is performed by stevedores, who remain at the lighterage-station continuously, no one ever being allowed to go to the city for six days after he has labored upon a vessel. The same rule refers also to the coopers, for you will remember it was stated that the great danger consisted in going into the hold of an infected vessel during the time of her discharge. When the cargo is entirely removed, the sides, and every part accessible, are subjected to scrubbing with brooms and water, after which a more thorough disinfection and fumigation follow, and the vessel is at once furnished free *pratique*. She is thus actually returned to commerce sooner than if permitted to go to dock and be subject to the usual process of unloading. There is, therefore, so far as yellow fever is concerned, no antagonism between commerce and quarantine.

Should the vessel have sickness at the time of entering port, or have had sickness or death on the passage, the vessel proper takes the same course: the sick are at once taken off, and the crew or passengers, instead of being at once discharged, are subjected to surveillance until a period of five or six days from the last case shall have transpired. The large use of steam transportation between this and yellow fever ports modifies in some respects the foregoing regulations. Reaching, as they readily can, this port within the period of incubation, I have established the rule that five days must elapse from their departure before any passengers or crew can leave ship. As this time is more patiently passed at sea than lying in the lower bay, the time of passage is usually made to fill the entire period. While five days is not the limit of incubation, I must depend somewhat upon the doctrine of averages; that is, if, in a hundred persons, passengers and crew, no case of fever is developed during that time, taking into account the possibility that with some it may have been in incubation at the time of their going on board, I conceive there would not be one chance in five hundred for it to develop on the sixth day. Passengers, if no sickness has occurred, are at once allowed entry to the city. Should there have been sickness, the course already indicated would be followed out. The steamer

is lightered and subjected to the same process of cleansing as in a sailing-vessel. It is readily understood that, with steamers, time is a far more important factor than with sailing-vessels. With an average arrival of five or six weekly from yellow fever ports during the past summer, not one lost her sailing-day. Here certainly was no antagonism to commerce. That our visits of inspection were not fruitless, is shown in that sixty-two cases of yellow fever were taken from forty or more different ships during the past summer; that the protective measures were efficient, in that not a case reached the city or came above the Narrows.

I must now pass to the consideration of the remaining exotic disease, namely, *cholera*. Like yellow fever, its power of transmission has also been denied, and, when the epidemic ravages have spread over whole countries, general influences have been invoked to explain the ravages. With its more careful study, few, I think, will venture to deny, not only that it is transmissible, but also that it is *contagious*. In this, bear in mind the broad distinction between cholera and yellow fever. The latter has been stated as not strictly contagious, but transmissible through the media of many substances, and the confined air and bilge of vessels. The former is, however, directly contagious from person to person, and may be conveyed wherever there are routes of human intercourse, whether by land or sea. It is now, and has been for some time past, a favorite study to trace out the grand routes of the various epidemics which have, within the past forty years, so often scourged Europe and portions of this continent. We need here only refer to the results of those studies which have enunciated the principle of its transmission by the great routes of human travel. This is, then, the central fact of the study, that it is transmissible and contagious from the sick to the healthy, not by contact with the bodies of the sick, but with a material poison thrown off from their bodies, and capable of being conveyed to a distance. This recognized, we start from a presentable stand-point, and feel an assurance in efforts to prevent the spread of the pestilence.

The question has often been raised, "Why is cholera only an occasional visitant beyond the limits of its endemic home in certain provinces of Bengal?" It has been supposed that some unknown atmospheric conditions favor the extension of the disease at certain seasons, and not at others. True, as a rule, it is favored by high temperature, and checked by cold. Still there have been serious local outbreaks during the winter season, in India, Europe, and this country. Neither great moisture nor extreme dryness of air is essential for the prevalence of the disease, which has been widely diffused, and very virulent under the opposite extremes of moisture and of dryness. The disease has sometimes been known to break out with sudden violence after the occurrence of a mist-laden or a dust-laden wind blowing from a neighboring infected district, and it has sometimes received a sudden check after the occurrence of a violent storm. Probably human occurrences explain partially this remittent character rather than the influences of telluric or physical agencies. In studying the habits of the people, it is found the outbreaks occur coincidently with certain great

fairs and pilgrimages, when immense multitudes are brought in close relation, with all the accompaniments of filth, and utter lack of all sanitary precautions. The cholera shows itself every year, with more or less intensity, in an epidemic form, in places where the pilgrims gather. Many of these combine both fairs and religious ceremonies. A million of persons from every direction are gathered there to make their ablutions in the sacred waters. Passing the night upon the banks of the river, without any covering, they strive to enter the water as nearly as possible at the same time. Scarcely do the ceremonies commence than the disease breaks out, and twenty thousand have been known to die in eight days. Can we seek for a more efficacious mode of distribution? These pilgrims are not alone confined to Hindostan; but, over all countries where the Hindoo worship prevails, pilgrims come to these sacred shrines. They disperse to the northwest along the great caravan routes, carrying the pestilence in their train. A similar mode of distribution is recognized in the immense pilgrimages of Mohammedans to the sacred shrine of their prophet.

While, therefore, recognizing the original spot and district from which cholera may radiate in an epidemic form, as also the means through which this distribution has been chiefly made, the question naturally arises whether or no it may become temporarily endemic or acclimated in any district.

The acclimatization of disease. — The solution of this question becomes of the highest interest, when we consider the important bearing it has with reference to the origin and portability of several cholera epidemics.

The first point of observation is, that neither yellow fever nor cholera becomes acclimated in every point, where for a season they may prevail epidemically. Yet, wherever they occur in a zone where the meteorological conditions and physical formation of the soil resemble their original starting-point, it is not improbable the germs may remain for periods latent, to reappear in activity under some special conditions, the precise nature of which we are not as yet cognizant of. The facts illustrative of this, derived from yellow fever, are numerous and well established: those of cholera bearing upon it are now undergoing lively discussion by epidemiologists, both in Europe and this country. It is generally conceded that the starting-point, the *nidus* of country, so to speak, from which both diseases sprang, is comparatively limited; and yet we notice in the case of yellow fever that it is permanently endemic, in a large portion of the tropical and sub-tropical regions of the Atlantic coast.

It seems strange to tell you that yellow fever is older at all the northern ports of this coast that at New Orleans. Its first appearance in that city was in 1796, since which it has prevailed epidemically there thirty-five times, while not a season passes in which it is not more or less endemic. It appeared in Boston a hundred years previous to that date, nearly the same in New York and Philadelphia, and in Charleston ten times before its appearance in New Orleans. This seems the more remarkable, that, while it was so frequently epidemic upon all the chief cities of the Atlantic sea-board, New Orleans was more closely connected in geographical posi-

tion, commercial intercourse, language, and government with both insular and Central America, where yellow fever had prevailed for centuries. Several other places in that zone could be specified, where similar conditions are shown to exist: so much so, that we cannot always locate the precise point from which an epidemic may spread. It is difficult to assert the same with reference to cholera. Its appearance is relatively far more recent; its birthplace so restricted, its usual course through the medium of pilgrims so apparent, that epidemiologists have become accustomed to that source, and that alone, for the origin of every epidemic; and yet within the past year epidemics quite wide-spread have appeared, both in Russia and in this country, where the most diligent inquiry thus far has failed to trace the direct importation of the disease; and how would it be strange or strained if the analogy of yellow fever were applied to cholera? Both diseases have a paludal origin, both are transported by what we must term, in our present state of knowledge, a *germ*, for the transmissible principle in both shows so many of the properties of animal and vegetable germs, we can relate it in no other connection. Now, all analogous forms of life readily propagate themselves whenever a suitable *nidus* is presented, even far from their primitive origin, flourish for a season, pass into a period of quiescence, to reappear again after a season in all their first activity. The period of this dormant vitality is not known, and is it difficult to conceive of cholera what is now fully recognized of yellow fever? In the late cholera epidemic in Russia there was an interval of two years, 1867 to 1869, when it would seem to have been latent, and to have reappeared without the importation of any new germ; and Dr. Pelikan, as Director of the Medical Department of the Russian Government, says of the epidemic of the last season, that, "the infected localities being separated from each other by an immense space, entirely free from cholera, the idea of any genetic connection between the epidemics which visited these localities, falls of itself to the ground."

You are all aware of the wide-spread epidemic which has prevailed during the past summer in the Mississippi Valley. Starting in April in New Orleans, it pursued its usual course of propagation to all the principal towns along that river, varying in intensity in almost every instance with the cleanliness of the place, and the vigor of the local hygienic measures adopted to suppress it. Now, the most diligent, painstaking research has so far failed to trace it to importation. The heretofore recognized necessity for such an introduction left no stone unturned to establish it in this instance. The local sanitary authorities of that city, early impressed with the necessity of deciding the inquiry, have failed to find even the most distant trace of importation. The chairman of the State Board of Health of Louisiana gave the subject his earnest and prolonged research; the physician to the lazaretto at New Orleans affirms that he examined every vessel bringing passengers from European ports during the months of January, February, and March, that not a death occurred upon the passage, and not a case of diarrhœa was noticed. So far the universal negative testimony, of those whose duty would be to know, is entirely op-

posed to importation, and we are compelled to accept their report until a positive relation can be established. I might add incidentally, that many of the telluric and meteorological conditions of the Lower Mississippi resemble the Ganges, and that it would not be difficult at least to suppose, that the same dormant condition of the germ known to exist at the Ganges may occur at the delta of the Mississippi. If cholera be propagated by a germ, would there be a radical difference between that and all other germs? And yet, who has ever supposed that the germ, infection, or whatever it is called, of small-pox, became any the less active, much less lost its vitality, because it did not always prevail in an epidemic form: or, again, who ever failed to see the characteristic pustule of the vaccine, even though it had passed through hundreds since its renewal? You readily see, gentlemen, the solution of this question has an important practical bearing. If the doctrine of even *quasi*-acclimation be accepted, we must look even more closely than we have done heretofore to the fulfillment of all local hygienic measures.

Do not misapprehend me; this is no effort to show that cholera may spring *de novo*, wherever the external conditions of fomites and filth are favorable to its development; it recognizes the vital, living germ — the germ which, when active, produces cholera and nothing else; still a germ which, when it has found its appropriate *nidus*, may remain for a season quiescent, until seasons and conditions conspire to have it display its full power as an epidemic.

Perhaps it may be suggested here that the acclimatization of yellow fever is admitted, but not so with regard to cholera, since the germ of each is transmissible in different ways. The germ of yellow fever not being generated in the human system, nor transmitted from person to person in any way, but generated *outside*, and taken up after the manner of marsh malaria, easily finds its acclimatization in the many articles in which it is transported, but that cholera-germ, generated in the individual, could only be transmissible by the actual presence of those suffering from it. This, it seems to me, is the strongest point of the argument against acclimation. Yet who will decide the length of time during which the cholera-germ may retain vitality when in a favorable *nidus?* Who will determine the length of time that the trichinæ or the tape-worm may continue in the cestoid state unless favorable influences for their development occur? The little animalcules which swarm each mud-pool are, as the pool dries up, carried off with the floating wind, to reappear in full activity at the next summer's shower. The epidemic in Russia has shown that the germ remained vitalized for two years at least; how long would this continue under the more favorable influence of a tropical clime?

Dr. Macnamara states that if fresh cholera *dejecta* are dried on clothes and furniture, or in the soil, they retain their activity for years, if access of moisture be prevented. He had some of the *dejecta* which when fresh were mixed with sand and dried seven years before. Now, when mixed with water, and exposed to the sun, they could not be distinguished from a fresh cholera-stool.

Having established that cholera can be transmitted, it remains to show how this occurs, what are the agents of transmission, how it is influenced by the different modes of locomotion, the crowding of persons, what are the attributes of the generating principle, the means by which it enters the organism. In the limited time remaining, these can be treated only in the most general manner.

This contagion always follows the routes of travel, and never progresses faster than it can be transported by an individual himself. In this is of course included all that pertains to his progress; his baggage, merchandise, the vessel which carries him, everything indeed which accompanies him.

The poison of cholera is cast off with the characteristic discharges of the alimentary canal, and communicated to others in the following principal ways: —

By the soiled hands of the attendants who are not careful to wash before taking their food.

By means of bed and body linen, carpets, and other articles soiled by the choleraic discharges.

The discharges finding their way into the sewers and into the soil may spread the disease in various ways: 1. By percolating through the soil into wells and other reservoirs of drinking-water. 2. By rising with watery vapor into the air. 3. By becoming dried, and then dispersed with the atmosphere in form of an impalpable dust; or, in the words of Mr. Simon, Chief Medical Officer of the Privy Council, England, "It cannot be too distinctly understood that the person who contracts cholera in this country is, *ipso facto*, demonstrated with almost absolute certainty to have been exposed to excremental pollution, excrement-sodden earth, excrement-reeking air, excrement-tainted water."

Nor is it essential for this contamination that the infected person should be laboring under the full access of cholera symptoms. The affection is just as certainly transmitted, and probably more frequently, by persons suffering from mere choleraic diarrhœa. The essential germ is the same in both, and the choleraic diarrhœa of one will develop into the malignant form in another. Whenever it passes by a sudden leap from an affected locality to one not as yet poisoned, it is probably by some such transportation. Persons so affected are moving about, it may be travelling in cars or on river steamboats. Each dejection, miles separate, may disseminate the poison in the particular locality. Numerous authenticated cases are on record of propagation in this manner, and, during the epidemic of the past summer in the Mississippi Valley, its capricious meanderings were many times traced by this mode of transmission. Its importation to this country is of necessity by ships, and, as by far the greater portion of people enter this port, the danger from this source is relatively greater here than in any other. To show the activity it acquires after being retained for a time on board, let me recite the following fact: The steamship *England* arrived off Halifax, a few years since, with cholera on board. A pilot, with an assistant and his son, went off to the ship in an open boat. Hear-

ing that there was sickness on board, the men remained in the boat, which was towed at a considerable distance astern by a ten-fathom line. In this way the ship with the boat in tow was conducted to her place of anchor. The pilots then went on shore, and were never on board the infected ship. In the course of the next two days both men were seized with cholera, and one died. Both men communicated the disease to their families. In the family of one there were three cases, but no death ; in that of the other, besides the father who died, there were four cases, and two deaths. The only other cases of cholera in Halifax at that time occurred in the family of a man, whose two children were seized, after playing with soiled bedding which had floated on shore from the infected steamer ; one child died, the other recovered. The mother also took the disease and died. Surely if disease was ever communicated by infection, it was so in the case of these three families, the different members of which were in various ways brought into contact with the infecting material imported by the steamer.

An indirect proof of the contagiousness of cholera is afforded by the fact that the disease has never reached certain countries which, being separated from India by a wide expanse of ocean, and having little communication with that country, have escaped the infection. Among the countries are Australia, New Zealand, and the other Pacific islands ; the Cape of Good Hope, and the southern part of the west coast of Africa ; the Azores, Bermuda, Iceland, the Faroe, Orkney, and Shetland islands, and the western coast of South America.

Of the agents for the immediate transmission of cholera, *impure water* plays an important part. Whoever has kept pace with the many writings on cholera, will see the importance which of late years has been attributed to impure water as an excitant of cholera. Not only on the general principle, that water rendered impure by the presence of large quantities of organic matter, favors the spread of an epidemic, but also from water contaminated directly by cholera excretion. Now that public attention is fully awakened to this matter, and also the fact that, almost for the first time in this country, the epidemic of the past summer was carefully noted in many places, we have many interesting proofs establishing this source of poisoning. In the first case which occurred in Lexington, Kentucky, the dejections were thrown out, so that by percolation they reached a well situate near by ; twelve subsequent cases were clearly traced to this water contamination. In this connection, I can as advantageously notice as elsewhere, that out of a certain number of persons who are exposed to cholera contagion, whether by impure water, contact with excretions in any form, but a moderate percentage really suffer from such exposure : thus out of nineteen persons known to have drank inadvertently of water, in which cholera excretion had been thrown, but *five* suffered from the disease. Observations show that in a crowded community, apparently equally exposed to the same influences, the above figures are not far from the average, of those who will show actively the contamination. It happens, then, that a large majority of persons exposed to cholera-poison escape completely, or incompletely, though of the latter there are far more than of complete im-

munity. Of this category are the great number of choleraic diarrhœas known to prevail at the time of an epidemic. This immunity may extend to entire communities, for, after the recent presence of an epidemic, there is an indisposition for another, even though there may have been an entirely new importation; a condition somewhat similar to what we noticed in yellow fever — the community is for the time acclimated.

Let me return, however. Another fruitful mode of contamination is from soiled clothing. Again and again has it been carried into perfectly healthy districts by sending into such localities clothing which had been soiled by those suffering from the disease. Those, too, who wash such clothing are peculiarly exposed; indeed, it should be an established axiom that no contaminated clothing be washed until it has first been thoroughly immersed in some disinfecting fluid. Here, too, I may notice a clinical fact which is of practical value. There is good reason to believe that the fresh cholera-stools are nearly if not quite harmless; that their greatest infecting power coincides with the stage of commencing decomposition, and that in a more advanced stage of decomposition they again become harmless. The practical deduction is obvious: that attendants may, almost with impunity, wait upon those affected if the dejections are immediately thrown in some disinfecting composition, and care is taken to wash the hands and promptly remove soiled clothing. In addition to these direct modes of communication, the virus may be diffused through *the air*, and thus enter the system by the lungs. Its rapid dissemination in a locality attacked, the simultaneousness of a great number of cases in a given agglomeration of persons where contact has not been possible, the fact that persons may be attacked at a short distance from the suffering case, favor the proposition, and attest to the volatility of the cholera-germ. The distance to which the principle can be, in this way, transported, is probably limited, but still must be recognized in studying the active modes of propagation.

Pettenkofer, who has given to the subject long and patient study, insists that soil-saturation performs also an important part in this propagation; *i. e.*, that a porous soil, easily permeable to air and water, coinciding with an elevated water-level from subterranean springs, and especially coinciding with changes in the level of these waters, becomes an active agent in disengaging the poison once brought to it.

We have now no difficulty in understanding that cholera is a disease capable of being rapidly communicated from the sick to the healthy over an extensive population, and yet that, with ordinary precautions, the immediate personal attendants on the sick incur scarcely any risk of infection. In this respect, there is a very close resemblance between cholera and typhoid or enteric fever. The alimentary canal is in both diseases the chief if not the sole outlet for the poison. The bowel-discharges are the means for the infection, and, whereas the fresh secretions are comparatively innocuous, the subsequent fermentation of the discharges from a single patient may infect the drains of an entire district. Hence it follows that the inhabitants of a house with untrapped drains, half a mile or more away, may incur three times more risk of infection than the sick man's nurse or doctor.

Having established the proposition that cholera can be transported, and pointed out some of the principal modes by which it is transmitted, it remains, in order to complete the picture, to fix the *duration* of the *incubation*, for cholera, like all contagious diseases, requires a certain time after its introduction into the system to develop its specific character. The congress of 1865 at Constantinople discussed this point long and fully; for the fact that the period of incubation may be from a few hours to (as many asserted) several days, necessarily called forth the most varied opinions. It is probable some of this diversity would be reconciled if the choleraic diarrhœa, which so often precedes the more intense symptoms, could be more rigidly determined. In the practical operations of the quarantine, we cannot, from its greater facility of transmission, take the average incubation, as in yellow fever, but rather extend it beyond the extreme period, say *ten* days.

It now remains to deduce the preventive measures, based upon these views of its history and modes of transmission. Our remarks will apply only to those applicable to its ingress by way of the sea. First, then, no arbitrary rules can be laid down which shall be applicable to all vessels. Every arrival of a vessel with cholera must, having in view all the general laws we have laid down, be judged by the particular features which belong to that case. While, as a rule, every vessel, its passengers and crew having had cholera upon its passage, or at the time of its entry, should be subjected at least to a quarantine of observation, still this rule is not without exceptions. For instance, two steamers entered the harbor last fall, having had deaths from cholera, and another with one well marked, and several of choleraic diarrhœa on board, neither one of which was detained more than twenty-four hours; and yet I felt quite secure in allowing them to proceed to the city. Why was this? In the first, the case was a cabin-passenger. The nature of the disease was almost immediately detected by the surgeon. At once absolute isolation was enforced, passengers from neighboring staterooms were removed, dejections disinfected, and care taken with reference to soiled linen. Seven days had elapsed since the death; when the vessel entered, the state-room had been scrupulously cleaned and disinfected daily. Here, then, every intelligent preventive measure had been employed; the time of incubation, when any passenger having contracted the disease before entering the vessel, was past, and, in view of the measures employed, I had only to consider the possibility of contamination from the particular case.

The other death was in the steerage, so sudden that the surgeon was not informed until actual collapse. On inquiry, no dejection had taken place except at the water-closet into the sea; none occurred after the collapse; the clothing was at the time examined to see whether any stain was upon it; the body was at once thrown overboard, all the effects disinfected, and ten days had elapsed since the death, on their arrival. Wherein would a quarantine of observation have helped me in this matter?

In the case of cholera which entered the port, every precautionary measure had been adopted; the most rigid examination and inquiry could not detect other cases of choleraic diarrhœa than those referred to. The period of incubation, from acquiring it before entering the ship, had passed, and,

with no evidence of contamination to others, the vessel was allowed *pratique.*

In acting in this manner in the above three instances, I but followed on a limited scale what is universally recognized by all the European governments, and to which all their later efforts have principally tended, namely, to suppress the disease as far as possible at its source. They feel that the great field for precautionary measures is in the home of the disease, and the local governments are, as far as possible, discouraging the great pilgrimages, with the large agglomerations of people, and their subsequent religious rites, with already an appreciable diminution in the routes of transmission.

A vessel arriving, however, with several cases on board, would be compelled to undergo the full ordeal of precautionary measures. The passengers would be removed from the vessel, subjected to a quarantine of observation ; any sick appearing be promptly removed to the hospital located on another island, a mile distant from the island where the quarantine of observation was enforced. In the mean time all clothing would be thoroughly washed, aired, and disinfected, and, when eight days had elapsed without the appearance of a new case, they would be allowed to leave. In the mean time the vessel, after being subjected to thorough cleansing and disinfection, would be allowed *pratique.*

In the restrictive measures there is no blind formalism, nor any mysterious proceedings. All are deducible from the accepted notions of the history, nature, and modes of transmission of the disease. If this principle is faithfully carried out, there will be no antagonism between sanitary and commercial interests, but most of the measures adopted in behalf of the one will indirectly promote the prosperity of the other.

PRINCIPLES AND PRACTICE OF QUARANTINE AT THE PORT OF CHARLESTON, S. C.

BY ROBERT LEBBY, M. D.,

Health Officer of South Carolina.

THE principles expressed and required by our quarantine code in South Carolina, is the prevention and non-introduction of contagious and epidemic disease into the sea-ports of the State, by vessels trading therewith, and the extension of such disease into the cities and towns by such communication, and causing as little annoyance to commerce as possible, while at the time affording perfect protection to the health of our citizens, from such commercial intercourse.

To illustrate the principle and practice of our laws and their execution. Vessels coming from ports, where at the time of departure no contagious or infectious disease existed, they are visited, and their condition examined into, and are detained no longer than to make the examination by the boarding officer.

Vessels arriving from ports, where such disease existed, and there has been no case of sickness during the passage, are detained from fifteen (15) to twenty (20) days; during said detention, they are thoroughly cleansed, fumigated with sulphur, carbolic acid, etc., clothing, bedding exposed to the air frequently when the weather will admit, and the vessel painted. If no case of disease occur she is allowed to proceed to the city. Secondly. If a vessel arrives from an infected port, and has had cases of sickness on board after leaving port, she is quarantined thirty (30) days and even longer. The sick are immediately removed to the lazaretto eight miles below the city, with the bedding and clothing used by the sick, which are burnt on the island, as soon as the patient enters the hospital. If death takes place, the clothing worn is buried with the body. If they recover, as soon as convalescence takes place, they are disrobed of the clothing worn to that period, and the same destroyed. The body is carefully sponged with a weak solution of spirits, carbolic acid, and lukewarm water, and an entire fresh suit furnished. The hospital sheets are immersed in kettles of boiling water with carbolic acid, and not used again for several weeks. The vessel is treated in the same manner as before mentioned, and no communication held, except by the Health Officer's boat. She is anchored at the lower anchorage ground opposite the lazaretto; those without are detained at the upper station in front nearly of the Health Officer's residence. The Health Officer and assistants are required to reside at or near the quarantine ground from which point vessels are boarded and examined on arrival.

By a close and rigid adherence to these rules of practice as required by our laws of 1868, and first put into operation on 1st May, 1869, not a single case of yellow fever has been brought into the city of Charleston, while under my supervision of the coast quarantine of the State. Every summer, vessels arrive from infected ports, with and without yellow fever, between the 1st June and 1st October, excepting the summer of 1871, when no arrivals with disease from any West Indian ports came in. Two vessels from New Orleans with one case of remittent fever each, arrived. The quarantine register for 1871 records as follows, namely, —

On June 8 arrived from Matanzas,	healthy,	13 days' passage,	quarantined 10 days.
On June 12 arrived from Havana,	healthy,	4 days' passage,	quarantined 12 days.
On June 15 arrived from Matanzas,	healthy,	11 days' passage,	quarantined 10 days.
On June 22 arrived from San Juan, P. R.,	healthy,	12 days' passage,	quarantined 10 days.
On July 12 arrived from New Orleans,	remit. fever,	14 days' passage,	quarantined 11 days.
On Aug. 25 arrived from Havana,	healthy,	14 days' passage,	quarantined 30 days.
On Aug. 30 arrived from New Orleans,	remit. fever,	13 days' passage,	quarantined 7 days.

Five of these vessels were in ballast — one with tobacco, and one with staves, etc.; two last from New Orleans. The arrivals on 12th and 15th June did not go up to the city but loaded up Ashley River with phosphate rock, not nearer to the city than four hundred yards. The first on 8th June loaded at one of the warves with cotton, and sailed in the second week in July for a port in Spain. During the month of July of 1871, there were no arrivals from the West Indian ports, and only one from New Orleans. It will be observed there were five (5) arrivals from the West Indies during June, healthy crews, and in ballast; the last on 22d, and remained in the city after leaving quarantine to 12th July, when she sailed for Spain. This vessel with the days' passage and quarantine detention of twenty-two days, remained perfectly healthy.

I have digressed a little from the caption of the subject, to give a candid and honest "statement" of our practice in the execution of the important trust committed to my keeping, yet notwithstanding our rigid enforcement of law, the yellow fever made its first appearance in the city of Charleston on 3d August, 1871, in a populous part of the city. A journeyman baker living in a large steam bakery, three stories high, and he occupying a room in the third story. From this stand-point, considerable distance from the wharf where the vessel from San Juan loaded, not contiguous to any sailors' boarding-house, or their usual places of resort, this fever first commenced, and in its progress crossed and recrossed localities, as the wind would change from N. E. to E. to S. E., and backwards, until it extended over the whole city. We have here an example or instance, that with a well executed quarantine, with no arrivals from infected ports, that a lapse of forty-two (42) days after the arrival in June, the disease appears. In this case, it is strong presumptive (I may add positive) evidence that unless the sanitary police of a city are rigidly observed and enforced, that epidemic yellow fever can originate and extend over a city whose condition is such as to cause it. If there had been no quarantine, or a lax quarantine, these visitations would be more frequent, as in 1849, 1852, 1854, 1856, 1858, 1860, and 1864. In 1865, the

Federal officers in command of the city had it thoroughly cleaned, and sanitary police rules rigidly enforced. It continued clean and healthy, until the filling of low places with the scavengers' garbage, and opening of grave-yards within the city for the interment of the dead — the contents of sewers and drains put upon low lands, etc., etc., under the civil government. While such neglect of common sense sanitary regulations are permitted, no quarantine acts, however rigidly executed, can prevent the existence of epidemic disease. Such is the history of the fever of 1871 in this city. It was not of West Indian or foreign origin. *Experience* has fully shown that when incompetent officers are intrusted with the execution of such important trusts as quarantine acts, it is a serious defect in the appointing power, which exposes whole communities to serious calamities. One of the defects, says Dr. Brown, "is the paucity of salary." A second that their appointments depend "upon political party influences," without regard tō intelli gence or education.

REQUIREMENTS.

The first, and most important requirement wanted is a uniform system of quarantine laws on the Atlantic and Gulf coast. I do not mean a system to be inaugurated by the United States government, but the several states, the same code to be enforced at every station in each jurisdiction, and adopted by each state, namely as in New York and South Carolina.

Second. A uniform system regulating the charge for permits on visitation and discharging a vessel. It should be the same at every station on the coast, or abolished altogether.

Third. Telegraphic, confidential intercourse between health officers communicating the first cases of yellow fever, cholera, etc., and any information deemed essential to each station. This interchange of information should be monthly, or oftener if necessary.

Fourth. The careful examination of log-books of all vessels arriving at quarantine stations. More particularly vessels from the West Indies, Cape de Verdes, and along the track of the southeast trade-winds. A knowledge of atmospheric currents is of signal importance to health officers in tracing the progress of epidemic yellow fever, and can only be obtained from log-books of vessels traversing the great highway of nations. Notes of the prevailing currents carefully taken in each particular latitude from date to date, collated, and sent by each health officer to the Secretary of the Health Association to be consolidated and utilized, would prove of great advantage to science, especially physical science. For more extended views, consult Humboldt, also Ehrenberg, Maury, and Semmes," in reference to the whirlwind dust of the valley of the Lower Orinoco, which can be identified with the rain-dust of the Cape de Verdes as one and the same. A great deal is yet to be learned respecting the atmospheric currents in their relation to the propagation and extension of epidemic disease. Much more can be said on this subject. I have already occupied too much attention, more than I intended, and here conclude these imperfect remarks hastily put together as a public duty incumbent upon every Health Officer when requested to do so.

SOME ACCOUNT OF YELLOW FEVER AS IT APPEARED IN NEW ORLEANS IN 1873.

By S. C. RUSSELL, M. D.,
Secretary Board of Health of Louisiana.

Without doubt, the first case of yellow fever, which occurred in the Mississippi Valley, during the year 1873, was in the person of José Maria Arua, mate of the Spanish bark *Valparaiso*. This bark left Havana, June the 16th of the present year, in ballast, and arrived at the Quarantine Station, on the Mississippi River, June 24, and was detained there three days; after which she was released, and permitted to come to the city, arriving June 26th. She was docked at the head of Second Street, in the Fourth District (two miles above Canal Street); the business centre of the city. As to her treatment at the Quarantine Station the following letter from Dr. George Howe, Resident Physician at the Station, will show for itself: —

"Office of Quarantine Physician, Mississippi River.
October 12, 1873.

"To the Secretary of the Board of Health of Louisiana.

"*Dear Sir*, — Your official communication of 9th inst., requesting particulars concerning Bark *Valparaiso*, is just to hand and contents noted.

"The Bark *Valparaiso*, 'Spanish flag,' left Havana on the morning of 16th June, 1873, for New Orleans, with nineteen crew, and five sailors who worked their passage here.

"Arrived at Quarantine Station, June 24, p. m. All well. Notified the captain, Rosas, that two and a half days' quarantine were required to complete the ten days required by law. She did not get off until seventy-two hours after arrival — the tow-boat being detained below. She was visited three times daily by myself, and I saw the officers and crew each visit. She was fumigated with chlorine twice both in forecastle and between decks. Carbolic acid was used twice freely in pumps and scattered below, as also in forecastle. Being in ballast it was easy to distribute the acid freely and thoroughly. From 6 p. m. until morning during her stay here the hatches were removed in order that the cool night air might replace the warmer air of the hold of the vessel.

"The officers' cabin was twice fumigated, much to their disgust, and during an entire day they did not go inside.

"The officers and crew were in perfect health up to hour of sailing from here.

"The above are all the particulars concerning Bark *Valparaiso*.

"Yours very respectfully,

(Signed) "George Howe, M. D., *Resident Physician.*"

As has been stated above, the bark *Valparaiso* was docked at Pier 48, Fourth District, opposite Second Street. Above her lay several steamboats, first of which was the *Belle Lee;* above her, the *Wm. L. Pike*, and several Red River boats. The mate, Arua, was taken sick with the yellow fever on the 4th of July, and was carried, after being treated two days, down to the Third District, a distance of three miles, where he died on the 8th of July. His first physician, Dr. Manaigra, pronounced it yellow fever, and reported it as such to the Board of Health. Some members of the Board saw him after his removal, and unhesitatingly pronounced it a true case of yellow fever. Dr. Devron gave certificate as such.

The premises where Arua died, No. 485 Moreau Street, were thoroughly disinfected and fumigated, and *no* other case occurred in that neighborhood for the season. With the advice of Dr. Perry, pure carbolic acid spray was thrown on the walls, the floors sprinkled with it, and the neighboring yards and cess-pools were liberally sprinkled with crude carbolic and zinc iron.

Some vessels in the months of August, September, and October were docked in the same locality that the *Valparaiso* had occupied in the earlier part of the season; their crews suffered considerably from the fever. The bark *Putnam* was one of these; case sixteen was her mate. The captain was also sick with the fever, and recovered after the bark moved down to the Third District. Several other ships, also, after discharging their cargoes in the warehouses of the Fourth District, at piers 49, 52, 56, and 58, were taken down to the Third District, to piers 23, 24, 25, and 26, three miles below; there they communicated or conveyed the fever to the wharves of that locality. Some of these ships lost heavily; one had seven men sick, another four. These two lay at the same pier, namely, Pier 23 of the Third District. It was not until November 2 that the fever was finally eradicated by the persistent efforts of sanitary officer Newman, who cleaned up the wharves and batture, disinfecting both, as well as the surrounding neighborhood.

It is very difficult to dislodge this disease from under and about the wharves, where it is partially protected from the air, and there is an abundance of moisture and heat; besides, it is difficult of access, and filth is carried under them by currents and eddies. Nearly all sailors are taken to public hospitals, and death too frequently occurs. Of two hundred and twenty-six deaths by yellow fever this season, ninety-eight died in the hos pitals, and sixty-three recovered. Moving the sick in furniture wagons over rough pavements causes many a sick man to succumb, who might safely go through the ordeal under more favorable treatment. Many patients taken from warm beds, exposed to cold air, carted through the streets, die soon after admission, and sometimes on the way there. From many lodging-houses the sick are sent away to hospitals, as soon as the proprietor or his affrighted guests think he *may die* of the fever.

The fever in the Fifth District (Algiers) commenced, as has been stated, August 9 (case fourteen, already given), and continued until October 10, during which time there were thirty-seven cases and sixteen deaths. Like

the fever in the Fourth and Sixth Districts, it showed an extraordinary malignancy; in one house the entire family of three died of it in a few days. No direct origin of this fever could be traced (except that of Murray, case fourteen), and he was somewhat removed from the other cases in Algiers. It is probable it was brought from the Fourth District by some levee laborers. This district, like the Fourth and Sixth, was thoroughly disinfected by the sanitary officer, under the direction of the President of the Board of Health. One hundred and thirty-one barrels crude carbolic acid were used, and, as it is stated above, the fever entirely disappeared on the 10th of October.

There were also some scattering cases of fever in the Second District; these were treated as were those of other districts, namely, every locality where a *case* of *fever* occurred was thoroughly disinfected, until the fever disappeared, as will be seen by the able report of Dr. Clark, sanitary inspector of the Second District.

The history of the yellow fever in the city requires that all the important circumstances known should be mentioned. It is reported that four deaths of yellow fever occurred on the ship *Ada Oulton* when off the Tortugas, July 18 and 20. The *Ada Oulton* left New Orleans the day Arua died (July 8). She lay at or near the same pier as did the *Valparaiso*. If so, did the *Ada Oulton* get her fever from the *Valparaiso*, or did the germ under or about the wharves affect both ships alike? Might it not have found a suitable nidus under the wharf, where, under favorable circumstances, it manifested itself on nearly every ship or boat of that locality? The weather was at that time extremely warm and favorable to the propagation of the disease. It may be mentioned here, that the fever broke out last season, four squares from where the *Valparaiso* lay this year, and then there was not the slightest evidence of importation; in fact, the first case of 1872 was positively known to have been sporadic, yet there were thirty-nine deaths following it during the season.

The location of the fever this year was in the non-malarial portion of the city, mostly near the river, while the malarial section is near the rear, toward the swamp or marsh.

Of the thirteen officers, detailed by the Metropolitan Board to assist in sanitary work and disinfecting, no one took the fever, though all save one was unacclimated. Did not the constant use of disinfectants give them immunity from this disease? They were all exposed to it, day after day, nearly five months.

No colored persons were affected by the yellow fever this year, though they have suffered severely from small-pox and cholera.

Of the 226 deaths by yellow fever, only 68 were Americans, 58 were Germans, 29 Irish, 20 English, 10 French, and 41 from other countries. Of the 388 cases, only 68 were females. Deaths and cases by months were as follows: July, 8 cases, 3 deaths; August, 40 cases, 19 deaths; September, 183 cases, 108 deaths; October, 135 cases, 79 deaths; November, 22 cases, 17 deaths. The above were all that were reported to the Board of Health, though, probably, 10 per cent. of all the recoveries were not reported. This

would foot up as follows: $388 - 226 = 162 + 16 = 178$ recoveries; over fifty per cent. died.

Many physicians did not report their cases until the strongest evidences of dissolution were apparent; this, too, in defiance of the law requiring them to report all cases of contagious or infectious disease within twenty-four hours after cognizance.

The average duration of sickness in case of death was five days.

29 were under ten years of age.
28 were between ten and twenty years of age.
94 were between twenty and thirty years of age.
48 were between thirty and forty years of age.
22 were between forty and fifty years of age.
5 were over fifty years.

Excavations on streets seem to have had no effect on the spread of the fever this year. Several streets were torn up to re-lay and build railroads, and no single case of yellow fever occurred on any such streets.

Cases of yellow fever introduced from Shreveport and Memphis were no more malignant than our own. It manifested the same symptoms.

The neglect of sanitary measures and use of disinfectants made the only difference in malignancy between the fever of Shreveport and Memphis, and the fever of New Orleans and Mobile.

Malarial fevers have prevailed during the summer. In five months during the prevalence of yellow fever, there have been three hundred and forty-eight deaths from congestive, bilious, pernicious, paludal, intermittent, and remittent fevers.

There have been many severe cases of fever of a hemorrhagic character among children. These were at first called by inexperienced physicians, yellow fever, but, on close observation, it was found to differ considerably from true yellow fever, though many cases showed the strongest hemorrhagic tendency, even from the stomach. Recoveries from this were very frequent, and deaths very few. This fever is called by Dr. Faget, "hemogastric paludal fever." Not less than one half of the population of this city were afflicted with "dengue" (myalgia). Relapses from this fever frequently occur, and are often severe. Deaths have occurred from "Exhaustion from dengue," and some cases, after many relapses, have assumed the appearance of yellow fever, and have died.

The Board of Health gave special permission to the owners of the steamship Clinton to run between Havana and the Quarantine Station during the summer. Her agents agreed to employ only an acclimated crew, and to discharge her cargo at Quarantine, to be brought to the city on lighters, while the ship should return for another cargo. She made two trips only, leaving five men at the Quarantine sick with yellow fever, three of whom died. It is a remarkable *fact* the cattle boats of the same line, running between Havana and Galveston, had *no* single case of yellow fever among their crews and passengers. May not the ammoniacal odor from the cattle keep the poison out of the hold of the ship. As to detention at quarantine, time *only* is of no avail. The yellow fever germ only accumulates in

power in the closed-up ship. Some plan must be devised to root it from the ship thoroughly and effectually, especially from those vessels arriving from ports known to be strongly affected, as was Havana this summer. Commerce, even, should be discouraged from such a place, for a time.

If the sprinkling of carbolic acid and other disinfectants do not always entirely *destroy* the germ of yellow fever, it so weakens its influence, that those only much predisposed to it, take the disease, or those let down to it by other diseases, namely, relapses from dengue, diphtheria, etc. This was the case in this city this season, in sections where the yellow fever prevailed. Where there were no hygienic measures taken, the fever manifested itself with great power. No single colored person was attacked in New Orleans with yellow fever, but many died of it in Shreveport this year. Is it not fair to believe that when hygienic measures are fully understood and carried out, that epidemics of small-pox, cholera, and yellow fever will be very rare?

The Board of Health have met with considerable opposition in the matter of disinfection. Some physicians were unwilling to report cases of fever, fearing their patients and friends might be annoyed by the disinfecting corps, preferring the horrid fetor of cesspools and privies to "zinc-iron" and carbolic acid; thus allowing the disease to have its unrestricted course. This may be honest, but it looks like catering to the whims and caprices of their patrons.

In reviewing the above cases, it seems that twenty-seven of the thirty-three cases given, have a close connection with the bark *Valparaiso*, or with the cases in her immediate neighborhood. Of the six other cases, Nos. 2, 11, 18, 29, 31, and 32, the first three are expressed *as doubtful*, while the last three, in all probability, had their origin, as did the twenty-seven just alluded to.

In conclusion, it would appear that the fever of 1873 was imported from Havana, in the bark *Valparaiso*, though she was detained for a short time, and fumigated at the Quarantine Station.

APPENDED STATEMENT

Of A. W. Perry, M. D., Sanitary Inspector, concerning the course of Yellow Fever, and the methods and effects of Disinfection.

The yellow fever of 1873 commenced in this city on July 4, in the person of J. M. Arau, the mate of the Spanish bark *Valparaiso*, which left Havana in ballast, June 16, and arrived at the Quarantine Station, below the city, June 24. After a detention of two days, the vessel arrived in the city, and was moored at post No. 48, at the foot of Second Street. The man died July 8, with well marked yellow fever. On July 12, the mate of a steamboat, which was laid up for repairs at the same wharf, about thirty yards distant, was attacked with yellow fever, and died. From these two cases the disease slowly spread, there being six cases in July, and twenty-four in August. Of the first ten cases, eight had recent and direct communication with the first two cases, or had visited the vessel above mentioned. During the first week in August, the Board of Health commenced extensive disinfecting with

carbolic acid, of all places where yellow fever had been reported. The disinfection was performed in two ways, namely, When a case of yellow fever was reported, all the yards, alleys, and draws in the square, were sprinkled with crude carbolic acid by hand sprinkling-pots. About seventy gallons of the carbolic acid were used per square. This was done to destroy any disease germs that might be on the ground, and to prevent the spread of the disease germs over the other parts of the same square. Thirty entire squares, and twenty-one half squares where yellow fever had occurred, were thus disinfected in the Fourth District; and in only seven of these areas disinfected, were there any subsequent cases of yellow fever, and the total number of these cases, after disinfection, was eleven. The number of cases which occurred before the disinfection of the squares on which they lived, was ninety-one. To ascertain whether or not the small number of subsequent cases was because of the small number of persons liable to yellow fever, who lived in these squares, a census was taken of the total population of each square, and also of the white persons who have come to the city since 1867, the last epidemic year. In thirty squares, in which most of the yellow fever occurred, the total population was 5,223, an average of one hundred and seventy-four per square. Of these 1,249 were liable to take yellow fever, being nearly twenty-four per cent. liable. Of the liable persons, seven and three-tenths per cent. took the disease before disinfection, and nine tenths of one per cent. after disinfection. In the square bounded by Rousseau, First, Saraparu, and Fulton, from August 10 to September 8, there were six cases; the whole square was disinfected September 13, and there have been no subsequent cases. There are in this square thirty-three persons liable to yellow fever. In the square bounded by Chippewa, Annunciation, Eighth, and Ninth, there were from September 10 to 16, three cases of yellow fever; the half square was disinfected September 20. No subsequent cases have occurred in this square which contains persons liable to yellow fever. These statistics cannot be denied, nor can the conclusions to which they lead, be overturned by any isolated examples of failure, or bad consequences to a few patients.

The disinfection of the streets with carbolic acid by sprinkling carts was done to prevent, if possible, the disease from spreading from square to square; and this has practically been effected. On the second week in August, when the street disinfection was commenced, the cases of yellow fever were scattered irregularly over the portion of the Fourth District, between Chippewa Street and the river, which was the infected district. The greater part of all the cases, the present season, have been within these limits. Of six cases in July, six cases were between Chippewa and the river; of twenty-four cases in August, twenty-one cases were between Chippewa and the river; of forty-eight cases in September, thirty-eight cases were between Chippewa and the river; of thirty-one cases in October, twenty-one cases were between Chippewa and the river. Never before has yellow fever spread so slowly in this city; while in other cities, Shreveport and Memphis, the disease, undoubtedly derived from this city, spread with its usual rapidity and fatality. A few cases have occurred in Mobile, and were treated with the same method of disinfection, and with the result of extinguishing the disease. Nowhere in the

world has disinfection on so extensive a scale been carried on as in New Orleans; and it has consequently met with considerable opposition. In sprinkling the streets with carbolic acid, about twenty gallons were used to every one hundred yards, and this was repeated several times at intervals of from five to ten days. The large amount of acid used, made the air of a disinfected locality exceedingly irritable to the eyes, and sometimes produced nausea and headache. These disagreeable effects are due to the naphtha and napthaline which constitutes the impurities of the crude carbolic acid; these have no disinfecting value, and in future, a purer acid should be used which is not very unpleasant, and equally effective and cheap. This purer acid could not be procured during this last season. The purest carbolic acid that can be practically used has some offensive odor, and may produce headache and nausea in some persons; but it requires more evidence than has been presented by physicians opposed to disinfection, to prove that it is really hurtful. One physician has condemned it in public prints, and his evidence is, that he had a case, and after being sick four days, the pure carbolic acid was sprinkled on the yard, and the man died the following night. From this evidence, carbolic acid is condemned as being hurtful. It has also been asserted that the yellow fever appearing in the Fourth District during three successive years when disinfection was applied, shows that disinfection did no good. The yellow fever of 1871 was principally within three hundred yards of the corner of Magazine and Washington, and the fever of 1872 was principally around the corner of Jackson and Magazine Streets. In fact in three successive years the cases have occupied areas far removed from each other, which were not disinfected the previous year. It may even be admitted that in a few critical cases of yellow fever where life is wavering in the balance, the use of carbolic acid may cause a fatal issue; but this admission does not at all condemn disinfection as a hygienic measure. Hygienic measures are not for the sick, but for the healthy. The removal of cases of small-pox and typhus fever to special hospitals is practiced with extreme rigor by most European governments; although the removal of these patients from their homes unquestionably causes scores and hundreds of deaths in the persons removed, who without removal would have recovered. If these cases had not been removed, instead of scores and hundreds of deaths, there would have been thousands. The true principle of all sanitary operations "is the greatest good to the greatest number," and nobody but the sickliest kind of a humanitarian doubts it.

EFFECTUAL EXTERNAL SANITARY REGULATIONS WITHOUT DELAY TO COMMERCE.

By A. W. PERRY, M. D.,
Of New Orleans.

The desire to exclude epidemic disease seems to be universal among all civilized and half civilized people; but, unfortunately, the means used have not been adopted on scientific foundation, and have proved so burdensome to commerce, and at the same time so inefficient in their results in excluding disease, that they have been time and again adopted and abandoned. Quarantine has been enforced and abandoned already two or three times at New York, Philadelphia, and New Orleans. These vacillations have depended on the changing theory of the spread and development of epidemic disease, and ideas of business expediency. A large number of diseases have been supposed to be caused by germs diffused in the air, or upon some so called epidemic constitution of the air, or to be spontaneously generated.

The modern investigation and observation of those diseases which become epidemic, has continually diminished the number of those diseases which were supposed to spread by atmospheric diffusion over long distances, or which are caused by some peculiar condition of the air, and has rendered it almost certain that all epidemic diseases spread only by solid disease germs which must be carried from place to place by human intercourse. Not long ago it was the general opinion that the cholera poison was in the air, and it followed of course that a quarantine against the disease was perfectly useless; it is almost needless to say that this idea in regard to cholera has been thoroughly disproved: the conclusions of the Cholera Congress held at Constantinople were, that it is invariably propagated by human intercourse. A theory has been advanced in regard to yellow fever that it depended on some contamination of the air; this of course soon met with the objection that yellow fever does not appear suddenly spread all over a city, which it should do if the poison was in the air; because each individual is exposed at the same time to the same influence; but it commences in one locality and spreads gradually, though sometimes irregularly, over a whole city. These obstinate facts required a modification of the general air contamination theory. The idea was then advanced that the air which was poisoned by yellow fever formed an upper layer in the atmosphere, and when thrown into waves, the lowest point of the wave touched the earth and produced yellow fever where it struck. The steady progress of the disease from a focus which has frequently been accurately measured in feet per day, and the successive sickening of persons visiting or working in an infected locality have pretty well broken up, in the medical profession, these theories. These

theories and that of spontaneous generation are the common resorts of persons who are too lazy and impatient to trace the slow personal communication of disease. The actual germs in the case of yellow fever have not indeed been demonstrated, but the close analogy between yellow fever, small-pox, measles, and scarlet fever, renders it beyond a doubt true that they exist. The germ theory applied to yellow fever is the only one that will fully explain and harmonize the hitherto apparently contradictory facts, which have been observed in regard to this disease. The spontaneous generation of yellow fever in New Orleans has been deduced from the frequent cases in which it has occurred, in which there seemed to be no possibility of its importation; these have been too frequent to be denied, but they have been evaded by the invention of paludal or malarial yellow fever, to which all indigenous cases are said to belong.

The yellow fever germ may be compared to the cotton worm eggs: the cotton worm was unknown in this country thirty-five years ago, and must have been imported from some foreign country, as many other insects destructive to vegetation are known to have been. The severity of our weather in winter destroys all but a very few; perhaps not more than one out of a hundred million survives until the next season, those which are hid away in warm, sheltered places. These few increase during the first warm, moist weather, requiring weeks or months before they have become numerous enough even to be noticed: the importation of the eggs of the cotton worm in May or June would cause earlier increase, and therefore greater ravages. The yellow fever germ is an exceedingly tender organization of foreign origin, not developing below 70° Fahr., and killed by a temperature of 32°; out of millions of disease germs which exist at the close of an epidemic, only a few survive some of our winters and give rise to the cases of domestic or indigenous yellow fever the next season. In some winters all the disease germs are destroyed, and there are no domestic cases of yellow fever the next summer, or perhaps for several summers, until the germs are again imported. If some germs remain over from the previous summer, then the fever should occupy about the same neighborhoods for several successive years, which it has actually done in this city, in the Fourth District, for the past three years. The fact of the indigenous growth of yellow fever does not prevent the importation, or render useless a quarantine. The foreign yellow fever must be kept out, and the domestic destroyed or delayed by disinfection: it has been found by past experience that yellow fever does not develop into an epidemic here in less than fifty to sixty days: indigenous cases rarely occur before August 1st, and this is so late that an epidemic cannot follow; no epidemic has ever followed in this city when the first case has been as late as August 1st. Most, if not all of our epidemics here resulted from the importation of foreign yellow fever in May or June.

If quarantine does nothing more than to prevent the importation of the foreign disease it is worth far more than its actual cost, to the State. The demonstration that disease germs are solid bodies, makes it logically possible to exclude foreign epidemic disease by absolute non-intercourse, or by destroying the disease germs in transit. The first is not to be entertained for a moment, and the last has hitherto signally failed: both cholera and

yellow fever have been imported scores of times into New York, Philadelphia, and New Orleans, through a so-called strict quarantine: all these failures have occurred because the quarantine was not based on sound principles.[1]

Instances in which Yellow Fever has been brought through a "Strict Quarantine."

Date.	Into what Port.	By what Vessel.	From what Port.	
1853	New York.			
1856	New York.			
1870	New York.			
1871	New York.	Steamship Cleopatra.		
1859	New Orleans.	Brig Elizabeth Ellen.		
1862	New Orleans.		Key West.	
1862	New Orleans.		Nassau.	
1869	New Orleans.			
1870	New Orleans.	Steamship Agnes.	Honduras.	
1871	New Orleans.	Brig Mary Pratt.	Cuba.	
1873	New Orleans.	Barque Valparaiso.	Cuba.	
1873	Pensacola.	Golden Dream.	Cuba.	Vessel detained at Quarantine 21 days.

The following facts show a number of instances in which the yellow fever germ has preserved its vitality during a time of forty days or more.

Brig *Alderman Pirrie* brought yellow fever germs from Cuba to Swansea, Wales, after a passage of forty days, in July, 1843.

Brig *Henrietta* brought yellow fever to Swansea, Wales, from Cuba, after a voyage of forty-five days, in August, 1851.

Brig *Aime Marie* brought yellow fever from Cuba to St. Nazaire, France, after a voyage of forty-two days, in June, 1861.

Bark *Mangosteen* brought yellow fever from Cuba, to Swansea, Wales, in 1864, after a voyage of forty days.

In the above cases no persons were sick on board of the vessels when they arrived; but yellow fever, immediately after the vessels arrived, attacked persons who visited or who were employed in discharging these vessels.

Vessels should be detained longer than fifty days, which arrive from yellow fever infected ports, to be secure, if we depend on simple detention. I think that time, as an element in quarantine, is the least to be depended, the most oppressive to commerce, the most costly, and at the same time, the least

[1] The principle has been, that vessels infected with any disease would be spontaneously purified by remaining a time, varying from ten to forty days, at some place of detention. No doubt that most infections lose vitality after a time, but, to depend on time alone as a purifier, we should take the longest time that any disease has been known to remain latent on a vessel as a basis. Many vessels have been known to carry yellow fever poison across the Atlantic to France, England, and Spain, during voyages of from forty to fifty days, instances of which are given below.

effective. There is at most quarantines a nominal disinfection of infected ships: this consists in pouring into the bilge water a few pounds of chloride of lime or carbolic acid, and sometimes, though rarely, opening the hatches and putting small quantities of the disinfectant on the cargo immediately underneath. The disease germs may occupy any part of the vessel or the cargo, and, to be effective, the disinfectant should reach every part of the vessel, every crevice in the cargo. This can only be done, in a cheap, quick, and thorough manner by the use of gaseous or volatile disinfectants applied by a special apparatus which I will describe. This method will perfectly destroy all disease germs, and can be performed in from four to six hours, and will detain infected vessels less than one day.

The apparatus consists of one or more force blowing machines, put in motion by steam power, which are connected with a furnace for generating sulphurous acid gas, with an apparatus for impregnating air with carbolic acid vapor, and with a furnace for producing heated air: by the action of the blowing machines, air which has been charged with one of these disinfectants, is forced through flexible pipes into every compartment of the vessel to be disinfected, until it is filled with a saturated atmosphere. All the apparatus is to be placed on a small steam tug, which will be moved alongside of the vessel to be disinfected. The air forced into one part of the hold is diffused everywhere, and penetrates every crack and crevice by virtue of its elasticity and diffusiveness. This diffusive power of gases is well shown by the following experiment of Bertholet, quoted from Ganot's "Physics" page 127. At the Paris observatory, Bertholet took two glass globes, each having a brass stop-cock, and filled one with carbolic acid gas, and the other with hydrogen gas. He then connected the two globes by means of a hollow screw, and placed them so that the globe containing the light gas hydrogen, was uppermost; he then opened both stop-cocks, so that the globes communicated, and left them at rest for a few hours. Carbonic acid gas is twenty-two times heavier than hydrogen; now as the carbonic acid gas was placed in the lower globe, if the gases obeyed the usual law of gravitation, it should have remained in the lower globe and the light hydrogen should have remained in the upper globe: but this was not the case, for after a few hours Bertholet examined the contents of the two globes, and found that the gases were uniformly mixed in both globes: that is, one half of the hydrogen had passed down into the carbonic acid, and one half of the carbonic acid had passed up into the hydrogen through the opening in the stop-cocks, which was less than one eighth ($\frac{1}{8}$) of an inch in diameter.

Most iron steam vessels are provided with a system of pipes which lead from the engine room to every part of the vessel, and which are intended to distribute steam in case of a fire among the cargo. Through these pipes any gaseous disinfectant can be distributed by connecting with the pipes of the disinfecting vessel. In disinfecting sailing vessels small holes about three inches in diameter can be made in the sides. The disinfecting gas must differ according to the cargo, and with the disease; for disinfecting clothes, heated air of the temperature of 212 Fahr. should be used; for disinfecting the hold of a sugar or coffee laden vessel, sulphurous acid or carbolic acid vapor would be most suitable.

SOME DEFECTS IN THE IMMIGRATION SERVICE.

SUGGESTIONS OF REMEDY THEREFOR, WITH REFERENCE TO THE SANITARY INTERESTS OF THE COUNTRY.

By JOHN M. WOODWORTH, M. D.,
Supervising Surgeon U. S. Marine Hospital Service.

At the meeting of organization of the American Public Health Association one year ago, among the various special committees for investigation then formed, was one On the Sanitary and Medical Management of the Mercantile Marine, with Reference to Interests of the Public Health; to the chairmanship of which committee the writer had the honor of being appointed. Pressure of public duties in the supervision and administration of the Service — to my connection with which it is to be presumed that appointment was due — has left no moment unoccupied; yet, the committee cannot forego the duty of presenting to the Association a few remarks concerning some defects in the Immigration Service which, it is conceived, may be more efficiently and readily remedied through the action of Health Boards than in any other way; and the topic is so nearly allied to the subject assigned to the committee as to warrant this presentation.

During the past summer an investigation into the conditions of this service has been made in accordance with the following resolution of the United States Senate: —

"*Resolved*, that the Secretary of the Treasury is hereby directed to inform the Senate, at its next session, how many superficial feet of clear space are allotted to each steerage immigrant on board ship, according to the official reports of the collectors of customs; also to cause the atmosphere of some of the steerage compartments to be chemically analyzed by a competent expert, with a view of ascertaining its healthfulness; and also to have an examination made of the general treatment of immigrants on board ship; and to suggest such alterations in existing laws as may be necessary to secure effectual protection to steerage immigrants."

Without entering into the details of the investigation, which the writer has pursued as one of the commissioners appointed by the Secretary under this resolution, the fact that a personal examination was made of thirty passenger-carrying vessels, comprising twenty-one steamships and nine sailing vessels, together with an inspection of 8,488 steerage passengers brought thereon into the ports of Boston, New York, Philadelphia, and Baltimore, will serve to show that the opportunities for observation, and for arriving at correct conclusions, were ample.

At the present day, and with the gradual supplanting of sailing vessels by steamships in the passenger-carrying traffic, have come shorter voyages, increased space, improved accommodations, more light, better ventilation, more abundant supplies of more wholesome food and water, and an improved character of officers and crews; though in this latter respect there is, it is lamentably true, still room for improvement. As a direct result of these changes, the mortality among steerage passengers has been reduced over fifty per cent in the past five years; the respective percentages for the years at the beginning and end of this period, and for each class of vessels, being: —

	1867	1872.
On sailing vessels	1.167	.542
On steamships	.103	.045

This reduction is the proof of, and is undoubtedly due to, the improved administration of the Service, an improvement for which, it must be confessed, the United States is entitled to little, if any, credit. For while, in the language of ex-Secretary Boutwell, "the interest of the United States lies in the character and health of the emigrants this country receives, and therefore, ... it is deemed of the utmost importance to hold every foreign vessel to such regulations as will give greatest security to the lives and health of the emigrants," the fact is that, owing to the interpretation of the existing immigration laws of the United States, with the single exception of collecting a penalty of ten dollars for every immigrant passenger over eight years of age, who dies on the voyage, we do not hold foreign vessels to any regulation at all; and the examinations of such vessels by our inspectors of customs to ascertain "whether the requirements of law have been complied with" (Sec. 9, Act March 3, 1855, 10 Stat., 718), are purely perfunctory, and made as a matter of form only, so far as the exaction of any penalties for non-compliance with the requirements of law is concerned, But while this improvement in the immigration service has thus reduced the general mortality, the effect of the competition of steamships in driving sailing vessels out of the service, has also had much to do with lessening the death-rate. This is shown by the fact that where the service is to any extent still performed by sailing vessels, the mortality rises in direct ratio to the proportion of passengers carried by them. Thus, during the five years above referred to, while the mortality on sailing vessels was reduced more than fifty per cent., only about eight per cent. of the total number of immigrants was carried on them in 1872,[1] while nearly twenty-five per cent. was so carried in 1867.

[1] By this is meant the immigrants from all countries, a distinction necessary to be made, since in the *Thirty-third General Report of the* (*English*) *Emigration Commissioners*, just received, it is stated that less than two per cent. of the emigrants from Great Britain was carried in sailing ships.

The Commissioners add: "The proportion of those who go in steamers has shown a continuous increase since 1863, when it amounted to less than forty-six per cent. of the whole. The shorter passage, and the better accommodations of the steamers, more than make up for the additional cost." And the views herein presented are still further corroborated by the following language of these Commissioners: "The resort to steamers has also much diminished the mortality on the voyage. Among 230,531 emigrants in 545

A striking proof of the connection between these two facts, as cause and effect, is found in the statistics at the port of Baltimore during the spring of 1873. At this port, for the quarter ended March 31 last, there arrived 1,602 steerage immigrants, of whom 711 were brought by sail, and 954 by steam. Of the former, thirty-two died on the voyage, and only two of the latter, being in the ratio of one death to every 477 steam-passengers and the frightful proportion of one to every 22.2 sail-passengers, the equivalent of an annual death-rate of over two hundred and twenty-eight in the thousand on sailing vessels.

This, however, is an exceptional instance; and the fact is indisputable that within the past five years, owing partly to the effective, energetic supervision of the service by governments, which have a far less vital interest in the welfare of the emigrant than we have in that of the immigrant, *ex. gr.*, these of Great Britain and Germany, partly to pressure of public sentiment, somewhat to competition, and, undoubtedly, in a certain degree, to an improvement in the class of immigrants themselves, there has been a vast and satisfactory improvement in the immigration service.

Aside from the unsatisfactory material of which the merchant marine is composed, the recognition of which fact has given rise to the expressive phrase "the unseaworthiness of sailors," aside from this is the question, What may sanitary organizations do? not in the line of quarantine, nor of local health regulations, nor of the immediate protection of their ports and communities; but in the broader field of Marine Sanitation generally?

The annual influx by immigration of a quarter of a million souls into the port of New York alone, is a fact of such magnitude as to imperatively compel the earnest consideration, not only of its Commissioners of Emigration, its Health Officer of the Port, and of its municipal Board of Health; but it also demands the attention of this representative body, and such action by it, and through its agencies, as may tend to secure needed legislation in a direction now in a measure overlooked. As an appendix to the report of the investigation already alluded to, we have had the honor to submit to Congress the draught of an act "to Regulate the Carriage of Migrant Passengers to and from the United States in Steamships and other Vessels," in perfecting which the aim has been, to make it simple, concise, and equitable; avoiding the creation of new and unnecessary machinery for its execution; studiously refraining from any inteference with existing organizations, some of which (as at the Port of New York), are conducted with

voyages to North America, of which we have received returns, the deaths were only 102, which, taking the voyage at twelve days, is equal to a mortality of only 13.38 per 1,000 per annum."

Since this paper was written, the returns for the year 1873 have been so far completed as to admit of a suggestive comparison being made on this point for the past seventeen years. During 1856 only 5,111 steerage passengers were brought to the United States on 22 steam voyages, as against 136,459 passengers on 552 sail voyages; during 1873 there were brought 258,519 passengers on 675 steam voyages, as against only 9,345 passengers on 54 sail voyages. An analysis of the returns further shows that, while in 1856 the average number of sail passengers per voyage was about 247, as against an average of only 173 in the year 1873, the vessels of the latter year were vastly superior in capacity, equipment, and accommodations to those of 1856.

exceptional fidelity and thoroughness; defining its requirements as directly and clearly as the conditions of the service will allow, and where such conditions are vague or variable, seeking to secure the necessary flexibility and comprehensiveness without voluminous detail; and, finally, recognizing the rights of capital already invested, by assimilating the proposed enactment to the existing laws of other countries, so far as this may be done without sacrificing the paramount interests and welfare of the immigrant.

The following is a brief summary of the proposed act: —

By the use of the term *migrant*, covering both "emigrant" and "immigrant" passengers, much verbiage is dispensed with in the first section, defining the application of the act, without sacrificing clearness or comprehensiveness.

Section 2 requires one hundred cubic feet of clear space to be furnished throughout the entire voyage for each statute passenger on the uppermost between decks, and one hundred and twenty cubic feet in the second between decks; no passenger to be berthed in a sailing vessel below the uppermost between decks, nor in a steamship below the second between decks, nor in any vessel in any space where the vertical height is less than six feet, nor upon any orlop or temporary deck or platform.

Section 3 provides for a proper privacy for the sexes by berthing single male passengers forward, families next, and single female passengers aft, the respective compartments to have separate means of light and ventilation, and of communication with the deck.

Section 4 prescribes the mode of construction and the arrangement of berths, their size, location, etc.

Section 5, instead of lengthy detailed diet tables, provides that every passenger shall be daily supplied with good food.

Section 6 provides for the employment of physicians on vessels of a given capacity, and requires from them certain reports on vital statistics, hygiene, etc.

Section 7 authorizes an experienced matron to be engaged as *steerage stewardess* on vessels of a given capacity and upward, who shall be employed in "assisting to maintain cleanliness, order, and discipline among the female passengers."

Section 8 orders suitable lavatories and water-closets — one basin and one space for each fifty passengers — distinct sets for each sex, and those for women and children to be easily and safely accessible in all weathers.

Section 9, in enjoining the carriage of life-buoys or preservers, and of boats sufficient in number and capacity to float or carry the largest number of persons — passengers and crew — the vessel may be rated to carry, provides that "suitably constructed life-rafts," etc.

Section 10 directs a sufficient number of portable fire-extinguishers to be carried in readily accessible places, in addition to the usual means of extinguishing fires.

Section 13 extends the provisions, requirements, and penalties of the act "for the better protection of female passengers."

Section 14 recognizes the rights and interests of the citizens of the port in

the character and condition of its immigrants, by authorizing boards of health or kindred bodies to prescribe the necessary sanitary regulations.

Section 15 makes the approval of the Secretary essential to the construction and enforcement of such regulations as provisions of the act.

Section 16 entitles informers, other than officers or persons charged with the execution of the act, to a reward of one half of any sum or sums forfeited under the act, and paid upon their information.

Section 19 requires a report of such deposit to be made to the Secretary of the Treasury within twenty-four hours after its receipt.

Section 20 provides for the formation of a Board of Appeal, consisting of the Collector, Surveyor, and Naval Officer of the port.

Section 21 gives the Board of Appeal discretionary power to inflict an additional penalty.

Sections 24, 25, and 27, are the entitling, defining, and repealing sections respectively.

Such is an outline of the main features of the bill; but it is to sections 14 and 15 that I desire expressly to call the attention of the Association. Recognizing the citizens of the State and of the port into which immigrants come, as the ones most directly concerned in their arrival in the best condition, and admitting the unsettled status of marine sanitation on certain points, as well as the varying requirements of different ports, it has been sought on the one hand to give the necessary comprehensiveness to the act in this respect without making it cumbrous in details; and, on the other, to make it sufficiently flexible to conform to the advances in sanitary knowledge by utilizing Boards of Health as advisory bodies concerning those subjects which, from their nature, cannot be accurately and permanently defined and regulated by statutes.

The full text of these sections is as follows: —

SEC. 14. That the Board of Health, or equivalent body corporate, of any port of the United States to which migrant passengers are brought, under the provisions of this act, may prescribe such rules and regulations for preserving order and discipline, and for securing cleanliness, ventilation, and other sanitary requirements on board ship, as such board or body may deem best calculated to preserve the health and morals of such passengers: which rules and regulations shall be submitted through the collector of the port, with such indorsement as he may think proper, to the Secretary of the Treasury of the United States.

SEC. 15. That such rules and regulations as provided for in the preceding section shall, after approval by the Secretary of the Treasury, be construed and enforced as provisions of this act: *Provided*, That the Secretary may at any time suspend or annul such construction and enforcement.

But for the fact that the criticism has already been made, it would seem hardly necessary to say that this action is not intended in any wise to interfere with, or to intrude upon, the recognized functions and prerogatives of Health Boards. If this were the true meaning and intent of the sections, their enactment would be useless, but nothing more, since such legislation

would be clearly unconstitutional and could not be enforced. Nothing in all the vexed question of State rights seems so clearly understood, so uniformly admitted, so absolutely unquestioned, as, in the language of Chief-Justice Marshall, "the acknowledged power of a State, to provide for the health of its citizens."[1] But it is probably equally obvious that the National Government, in the exercise of its express powers, that, for example "to provide for the general welfare," may use means that may also be used by a State in the exercise of its acknowledged powers, that, for example of regulating quarantine and health-matters of every description, the laws concerning which are component parts of that immense mass of legislation, which embraces everything within the territory of the State not surrendered to the General Government.

And if, in the exercise of such express power, Congress should seek to make available the advice and counsel of experts in sanitary matters, and of those most vitally interested in the subject, by providing a legislative agency through which they may exert an influence beyond the confines of State boundaries ; by directing the executive officers of the nation to adopt and enforce the suggestions of local authorities ; and by adapting its own legislation to the aid and furtherance of the same objects as that of the States, but with ampler powers ; it was conceived that such an aim would be, to borrow still further from the illustrious jurist above quoted, "in that spirit of harmony and conciliation which ought always to characterize the conduct of governments standing in the relation which that of the Union and those of the States bear to each other."

It was also conceived that such an aim would be in entire harmony with the pronounced end and aim of all sanitary science — the prevention of disease and the protection and preservation of the public health. To wait until the potential or active germs of disease, in the persons of poorly-fed, badly-lodged, etiolated, anoxemiated, and generally demoralized emigrants, actually arrive within the jurisdiction of the port before enforcing preventive and preservative measures, is hardly the highest sanitary wisdom. To deliberately reject an offered auxiliary which might secure the enforcement of such measures from the first moment that the immigrant sets foot on deck, nay, even before this, by providing for such measures in the construction, equipment, and belongings of the vessel itself, to reject or oppose this, because of some fancied or real encroachment upon, or conflict of, authority, is decidedly less than average wisdom, even of the secular variety.

[1] Gibbon *v.* Ogden, 9 Wheaton, 205.

SAILORS AS PROPAGATORS OF DISEASE.

ABSTRACT OF A PAPER ENTITLED "THE HYGIENE OF THE FORECASTLE."[1]

BY HEBER SMITH, M. D.,

Surgeon in charge U. S. Marine Hospital Service, Port of New York.

. . . .

WHILE the ocean is the great highway of commerce, it is also the great highway of disease; and those who frequent its trackless paths too often become veritable highwaymen, robbing not only individuals but communities of that which is dearest to them, by developing and propagating diseases which are thoroughly preventable by the simplest sanitary observances.

The forecastle of the ship is to this hour *the* neglected point of sanitary police. The absence of effective measures of protection to seamen, notwithstanding the more or less earnest efforts made in that direction, has become proverbial; but it is particularly noticeable in regard to sanitary requirements, because in this respect sailors are so helpless, and the demand for interference is so urgent. Sailors are not brought under sanitary observation as they should be. They come and go. No one cares for them but to use them for the advancement of selfish purposes; and thus it happens, in the ordering of an inexorable logic, that the public weal is jeopardized by the wrongs that the whole world has knowledge of, but still looks upon with indifference and neglect.

[1] As intimately correlated with the subject of my paper on the Immigration Service, the following extracts from Dr. Heber Smith's contribution to the forthcoming Annual Report of the Supervising Surgeon of the United States Marine Hospital Service, form a valuable complement thereto; and I take pleasure in furnishing them for publication through the American Public Health Association. Their perusal forcibly suggests the competency of State and municipal authority to legislate upon the questions involved in the sanitary interests of individual ports and communities, pending the proverbially tardy movement of such large bodies as those charged with the duty of providing for the general welfare.

It would seem to be beyond dispute, as Dr. Heber Smith asserts, that many of the gravest diseases are introduced and disseminated through communities to a greater extent by sailors than by all other agencies. In what measure this is avoidable by sanitary science is certainly a legitimate subject for investigation by sanitary students, and of action through proper channels by sanitary organizations. If such study and action shall result in ameliorating and improving the physical condition of seaman, in the attempt to protect the health and lives of landsmen, or *vice versa*, another illustration will have been furnished of the benign influence and catholic scope of sanitary science — a science, the followers of which may, beyond all others, rightfully adopt as their legend and device, the terse but all embracing trilogue: *Humani nihil alienum.* J. M. W.

WASHINGTON, D. C., *September*, 1874.

The dissemination of cholera, small-pox, typhus, yellow, and relapsing fevers, and particularly of venereal diseases, in all their varied forms, is, probably, more to be dreaded from sailors flitting about from port to port, than from all other sources. It is indisputable that no outbreak of cholera has occurred in this country that has not been imported here in ships, and that the same is true of yellow fever.

When relapsing fever, that scourge of the poverty-stricken centres of the old world, first made its appearance in this country as a recognized disease, namely, in Philadelphia in 1844, it was shown conclusively to have been brought in Irish emigrant vessels; and, as showing the important part sailors played in the dissemination of the same disease when it visited this city in 1869 and 1870, the following extract from the report of Prof. Stephen Smith, made to the New York Board of Health in the latter year, is most significant: —

"It (relapsing fever) was also discovered at 332 Water Street, 337 First Avenue, and in the forecastle of the steamboat *Bridgeport*.[1] A careful examination of these latter cases proved very conclusively that the steamboat employées contracted the fever at 59 Cherry Street. One of the steamboat hands lodged at No. 332 Water Street, and communicated the fever to the family. On the night of his relapse the sailor lodged with the family of his sister at No. 337 First Avenue, and after the usual period of incubation, fever appeared in this family, and five persons suffered."

What an agency sailors have been in propagating venereal diseases, is told in the early history of the New World, from the time that Spanish sailors first infected the natives of the West Indies, up to the eighteenth and nineteenth centuries, when whole tribes were almost entirely swept from many of the South Sea Islands, by a disease unknown among them until the arrival of European navigators. But this is a problem too vast and complicated for discussion within the limits of this paper. It is not in diseases which involve moral sanitation also, but rather in those in which physical hygiene alone may be of avail, that there is much of promise at the present time.

What sailors are to-day in propagating venereal diseases may be best shown from the records of this office. From August, 1871, to October, 1874, out of a total of 6,075 patients treated, 1,436 were affected with venereal diseases, being over twenty-five per cent. And even this record is incomplete, for the reason that many sailors are treated for these diseases by physicians in private practice, or "Drug Store Doctors" prescribing for them over their counters, many of them receiving no treatment whatever. Thus, while it is true that many come under observation at a later period with aggravated symptoms, the fact is still patent that considerably more than one fourth of the diseases of seamen at this port are of venereal origin.

When the guardians of the public health may by authority "be present at the building of the ship to modify its construction; in the hold where the cargo is stowed to insure cleanliness; on the upper decks to secure light, air, and convenience; at the embarkation to enforce personal ablution, and

[1] See cut, and description of this forecastle, on pp. 452, 453.

other preparation for the voyage; on the passage to guard against unforeseen dangers, and to correct the errors of indolence and indifference;"[1] and, when they may be in the forecastle first, last, and all the time, to watch over and prevent its inmates from infecting each other and those among whom they may be thrown when they are at length brought to their desired haven — when all these things shall have been accomplished we may then gird up our loins for an attack upon this Pandora's box of disease, by whose wide-spread, all-pervading reign medical skill, social science, and vital statistics are all and equally set at naught.

For a graphic portrayal of the sailor as a sanitary subject, I know of nothing better than this report of Dr. Judson's gives: "The reckless habits and vagrant propensities of seafaring men, as well as the unsanitary condition of the portions of the city in which they lodge, make them peculiarly liable to become the medium for the spread of contagious and infectious diseases. The services rendered by the sailor to commercial and national prosperity, his exposure to danger and suffering, his romantic and generous disregard of self, and his freedom from domestic and conventional restraints, — points in his character and history that have thoroughly enlisted the philanthropist in his behalf, — are so many reasons why his sanitary condition should be faithfully studied." . . . .

"The diseases and deaths that are witnessed at the 'Seamen's Retreat' and among the sailors admitted to the New York and Brooklyn city hospitals, are probably, in a very large proportion of cases, the sad results of careless and sinful living.[2] To give the homeless sailors of our port friendly recognition, and the evidences of human sympathy, is to give them much needed moral support and protection against numerous and preventable forms of sickness and death."[3]

The sickness rate among seamen is probably greatly augmented by the want of light and air; and the presence of dampness and filth so often observed in the forecastles of even the largest and best equipped sailing and steam vessels. The following notes from my inspections of emigrant vessels will present some of these sanitary defects.

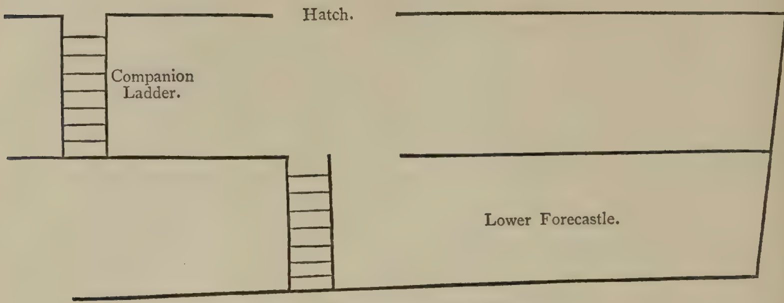
"Steamship *Helvetia*, 3,327 tons. Lower forecastle twenty-seven feet from stem to bulkhead; twenty-four feet in width at bulkhead; seven and a half feet between decks. Light and air admitted by a hatch six by four feet, and two air ports, each nine inches in diameter, and which are closed at sea, occupied

[1] A. B. Judson, M.D., "Report upon Sanitary Condition of the Waterside and Seamen," *Report of Metropolitan Board of Health*, New York, 1869, pp. 142–151.

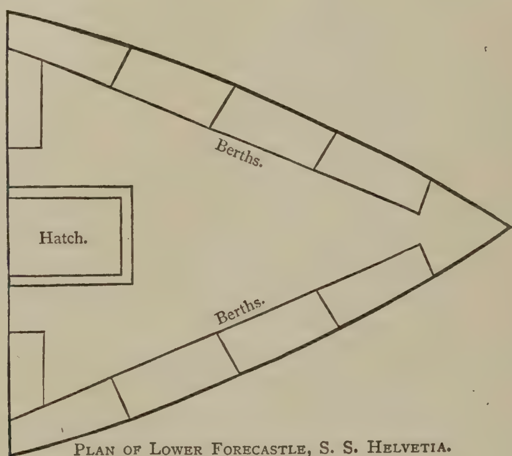
[2] Out of our whole mortality list consisting of seventy-seven in number, I can single out but ten cases which afforded anything like a fair chance for the successful exhibition of remedies; the balance were in such a wretched state when admitted, induced by starvation and criminal brutality and neglect on board, or by drunkenness and every species of sensual excess on shore, that little or nothing could be done for them.

[3] See the *Report of Dr. Moffatt, Physician-in-Chief of the Seaman's Retreat*, 1856.

by twenty-eight men in two watches. Very dark ; wet from leaky decks ; air close and offensive."



SECTION OF FORECASTLE OF S. S. HELVETIA.

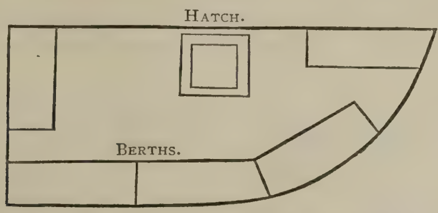


PLAN OF LOWER FORECASTLE, S. S. HELVETIA.

"Steamship *City of Antwerp*, 1,625 tons. Upper forecastle. Sailors quarters on the port side, approached by a narrow and circuitous passage by stooping under a portion of the anchor machinery. Light and air admitted by passage of entrance ; a four inch stove-pipe hole, and five air ports, open only in smooth weather ; occupied by twenty-two men in two watches. Dark and damp ; air close and offensive ; berths, bulkheads, and deck in a dirty condition. The firemen's quarters, on the starboard side, are similar to those of the seamen on the port side, but exposed to the further annoyance and offense of proximity to the passengers' water-closets."

"Ship *Constantine*, 1,280 tons. Lower forecastles for starboard and port watches ; twenty-three feet from stem to bulkhead ; ten feet wide at bulkhead ; seven feet between decks. Companion way steep and difficult. Light and air admitted by companion hatch, thirty inches square, and two air ports closed at sea. Ten berths in two tiers. Dark and damp ; air close, and

charged with ammoniacal odors. Bulkheads and berths black for want of scrubbing. Deck slippery with filth."



PLAN OF STARBOARD FORECASTLE OF SHIP CONSTANTINE.

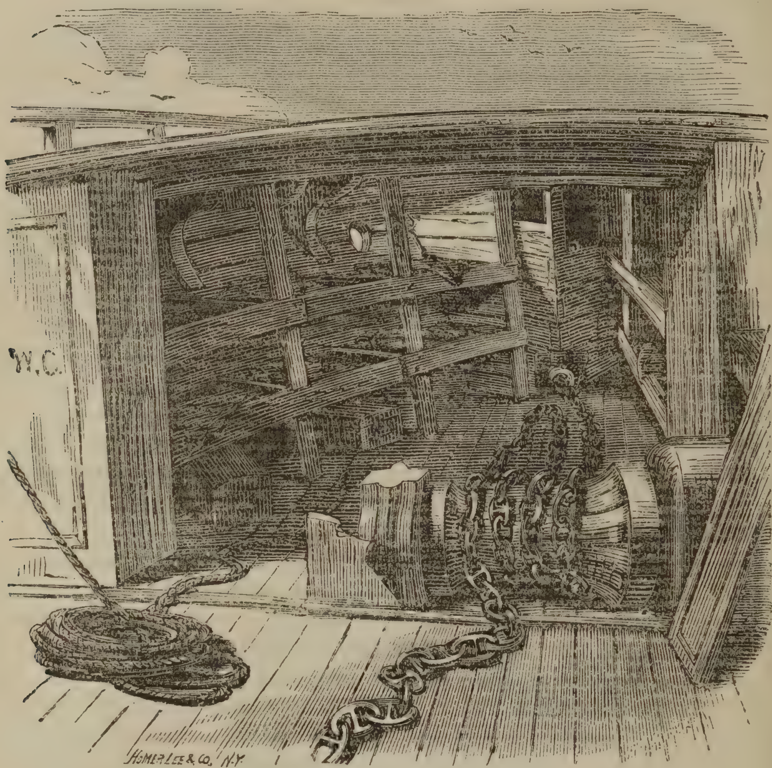
"To neglect the sanitary care of a ship's company shows a want of foresight which is not in keeping with the vaunted thrift of successful business men. Short voyages, the preservation of spars and rigging, and the safety of costly ships and human lives, depend in a fair degree on the physical condition of the crew. The ship-owner who wishes to guard his ventures against disaster by the use of all reasonable precautions, must shelter his crew in light, clean, and airy quarters, and take a personal interest in the treatment of the men. In the hundreds of total wrecks and disappearances occurring annually, if the actual truth in each case were ascertained and acknowledged, it is reasonable to suppose that an alarming proportion is due to the reduction of the working power of the crew by unhealthy quarters, unreasonable overwork, and, in some cases, by maltreatment."

This paragraph, published in 1869, may justly entitle Dr. Judson to the credit of having been among the first to call attention to the important subject of the commercial value of the seaworthiness of sailors, a theme which has of late years, and notably since Mr. Plimsoll's agitation of the matter, attracted so much attention both at home and abroad.

I desire to supplement Dr. Judson's description of forecastles by a description and illustration of two that I have found in my inspections, remarkable in two respects; first, in showing the manner in which men are stowed away in the least desirable places on board ship, while their comfort, and the preservation of their health is made secondary to the preservation of the contents of the sail room, carpenter's shop, and boatswain's locker; secondly, in showing the overcrowding and ridiculously inadequate means of ventilation provided upon some of the most gorgeous specimens of sound and river boats, which have been likened to painted harridans — beautiful only in spots. The following is the text of the English law upon this subject: "Every place in any ship occupied by seamen and apprentices, and appropriated to their use, shall have a space of not less than nine superficial feet for every adult, measured on the deck or floor of such space, free from goods, properly constructed, and well ventilated."

Our statute books define the limits of space which shall be allowed immigrants, but I am not aware that any such provision has ever been made for our sailors.

Ship *Surprise* of New York; China trade; one thousand and five tons; twenty-two years old, rebuilt eight years ago. Top-gallant forecastle twenty-three feet from stem to bulkhead; sixteen feet wide at bulkhead; six feet between decks. This space encroached upon by anchor machinery and water-closets, the latter three and one half by two and one half feet on

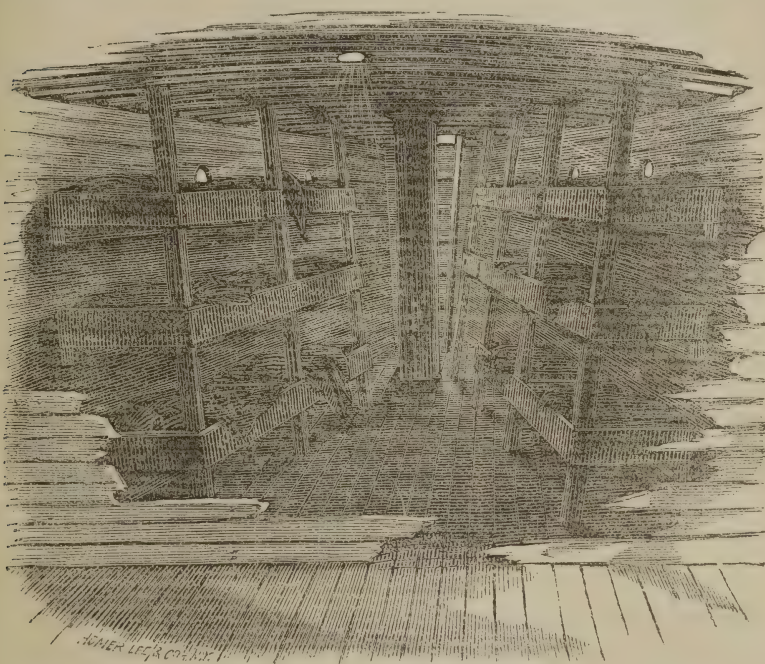


FORECASTLE OF THE SHIP "SURPRISE."

each side; nine berths on side, two five inch air ports. In heavy weather the men's chests were sometimes washed out on deck by sea coming in hawse-holes. This ship has ample accommodation for all her men in a house on deck, which is occupied in the order named as cook's room, galley, boatswain's locker, sail room, carpenter's and sail-maker's room, third mate and boys.

Steamboat *Bridgeport*, sixteen years old, plying between New York and Bridgeport; forecastle between decks forward, extending from stem to bulkhead a distance of twenty-seven feet; width at bulkhead twenty-one feet four inches; height between decks seven feet; twenty bunks arranged eight on one side, six on the other, and six against bulkhead; four six inch air ports and a five inch stove-pipe hole one foot forward of the bulkhead. The only entrance through a hatch three feet six inches by two feet situated as far forward as possible.

The forecastle of the *Bridgeport* is one of the best of its class, the cubic space per man, being about one hundred feet. In the forecastle of one steamboat inspected (the *Continental*), the cubic space per bunk was found to be less than fifty feet, with less adequate means of ventilation than the *Bridgeport* possessed. The forecastles of all this class of vessels afford



FORECASTLE OF THE STEAMBOAT "BRIDGEPORT."

illustrations of Dr. Billings' idea of the desire that must have governed the men who planned some of our prisons, namely: to see in how small a space human life could be maintained. They also illustrate the bottle plan of ventilation, for when it is considered that the air ports must be closed when under way, and that in rough weather the hatch also must be covered, we have the bottle complete, even to the cork.

A REPORT UPON THE SANITARY CARE AND UTILIZATION OF THE REFUSE OF CITIES.

By C. A. LEAS, M. D.,
Of Baltimore, Md.

We must not be expected in this connection to consider the subject of sanitary police or public hygiene in their very intimate bearings, or to philosophize over the baneful or noxious influences that excreta and refuse matters exert upon human life and health. Our object at present is briefly to contemplate their utilization. To discuss the soundness of the wisdom which demands the restoration as far as possible to the soil of such elements as were taken from it in its efforts to furnish man with an abundant supply of food and raiment, in order that this great storehouse of nature may be replenished with the materials wherewith to bring forth new evidences of its munificence would be a superfluous labor. We shall proceed then at the outset to the question,

WHAT IS REFUSE?

With a view to a clear comprehension of the nature or character of the substances refused by man that collect about his abiding places, and require removal from considerations of health and convenience, we assume that they consist of all refuse and offal from houses, the vegetable and animal garbage from kitchens, including coal and other ashes, the sweepings of houses and yards, old and worn-out pans, kettles, and boots and shoes; the scrapings and sweepings of streets, lanes, alleys, and courts, and dead animals, the inutilizable materials from factories and workshops, and lastly the offal and garbage from slaughtering establishments.

I have concluded to embrace within the scope of these remarks the utilization of only such of the refuse matters as come under the immediate and daily observation of public sanitary authorities, and as fall into their possession, either directly or indirectly, for removal and disposal. Although the garbage and offal from slaughter-houses, as a general rule, are removed sooner or later by the proprietors of such establishments to the country, and their most valuable fertilizing properties, by some method, utilized for agricultural or other purposes, yet it may be remarked that notwithstanding the efforts of many persons engaged in the butchering and slaughtering of animals, to preserve their premises in a cleanly condition, scarcely a greater outrage can be perpetrated upon the general community than the existence within the built-up portions of towns and cities of such establishments.

MODES OF SCAVENGING TOWNS AND CITIES.

The modes of scavenging large towns and cities, and collecting for removal the ordinary offal and garbage from the streets and dwellings, both in this and other countries, are various. In parts of the West Indies the dead animals and some other portions of the refuse matter are abandoned to birds of prey for removal, and it may be remarked that, as scavengers in this relation, they are prompt and efficient, doing the work quickly and thoroughly. In some European localities the owners of property are required to cleanse the public thoroughfares in front of their respective premises, and to remove the house offal. Such, for example, was the custom in the imperial city of St. Petersburg, previous to the inauguration of an American scavenging system, and it is no matter of surprise that cholera had prevailed in that city, more or less, during the entire year. In other places the neighboring farmers and gardeners, with their long covered wagons, collect the garbage and street manure, and apply it to their lands, the removal costing the authorities nothing. Again, in other localities, the scavenging service is wholly or partially intrusted to contractors, who mainly regard their own pecuniary interests rather than the public health or convenience. The municipal authorities of some towns and cities employ scavenging forces, but without fixed regulations, especially in the removal of garbage from dwellings. In some cities the collection of kitchen offal and house ashes is made separately by two sets of carts, with the view to the utilization of the ashes for the filling of sunken lots, and the vegetable and animal offal for the feeding of swine. Whilst in others it is collected together, the same cart containing a heterogeneous mass of vegetable, animal, and mineral matter.

THE PROPER MODE OF COLLECTING GARBAGE.

To secure and maintain the confidence of the people in any effort at the utilization of refuse, the manner of its collection and removal must combine both economy and efficiency. The garbage or kitchen offal, including coal and other ashes, and yard and cellar sweepings, ought to be collected daily in the warm seasons, and at least three times per week during the other portions of the year ; and with the view to constant cleanliness within doors, and a proper utilization of refuse matters, housekeepers, and all others interested, should be required to separate the ashes and earthy substances from the vegetable and animal offal, and in this form to present them with absolute regularity to the garbage collector, when he shall appear before their premises. The carts should be provided with a movable division board, so arranged as to shift, little by little, fore and aft, and with an upright bolt, by the drawing of which the board may fly open from below, when the cart is tilted. This partition will furnish two compartments, one for the ashes, and the other for the animal and vegetable refuse, and can be shifted as the seasons advance, or in proportion as the ashes predominate over the vegetable and animal materials collected. The garbage and refuse thus collected should be removed, either by water, rail, or carts, into the country, as remote as possible from any habitations, and into grounds inclosed and prepared for their

reception. The ashes should be placed under sheds, sifted, and stored as an absorbent and deodorant, and the vegetable and animal portions dumped into compost pits. A similar system was inaugurated in the city of Baltimore nearly twenty years ago, and it has maintained its popularity for nearly two decades, amidst all the changes of men and measures; and when honestly, energetically, and conscientiously executed, has given uniform satisfaction to the people. The present Emperor of Russia, some years since, caused a like system to be adopted in the city of St. Petersburg, after an imperial commission had reported that in all the European cities visited for the purpose of investigation, none could be found equal to it as a method of scavenging.

DISPOSAL OF MANURE.

Night-soil possesses, next to bullocks' blood, the most valuable manurial properties, being well adopted to the growth of all kinds of crops, but especially those requiring a large amount of nitrogen or ammonia. Is it then wise, is it true economy, to allow these sources of wealth to flow through our drains and sewers into the bays and rivers, to be forever lost, or if returned in any form, to be in the shape of epidemic, pestilential, and low forms of disease, and to cause the expenditure of millions to dredge out our docks, rivers, and ship channels? Sewers and drains were originally designed to convey away the surface drainage, and any system causing to pass through them all refuse matters, is a serious departure from the original intention, which should not be continued. Until, therefore, the people can be educated up to a well regulated system of earth or ash-closets, which ought to be as soon as possible, let us, at least for the present, stand by the cesspool plan of accumulation, and a perfected pneumatic suction system of cleansing, and utilize, in compliance with the plain dictates of nature, for the benefit of agriculture.

LOCATION AND CONSTRUCTION OF REFUSE DEPOTS.

The question here arises how are these waste matters to be utilized? Economy should always travel side by side with efficiency; therefore it is recommended to all towns and cities having navigable rivers running through or convenient to them, and not liable to ice-blockade, to employ these to convey away to proper dumping grounds in suitable boats, tanks, and hoppers, these refuse matters. If these do not exist, or cannot be made available, the next best agents for transportation are railroads, and lastly, if these are not convenient, or will not afford the required facilities, then there remains nothing but the horse and cart, which is the case in Baltimore, where the garbage and excreta are by this means transported about one mile and a half into the country. In any effort, however, to successfully utilize refuse, a market for the large amount of compost must not be overlooked in the selecting of depots for dumping purposes. This whole field must be well canvassed in its agricultural and horticultural bearings and relations.

The ground in quantity should be sufficient for all present and future purposes, and having a slight backward declivity. It should be inclosed by a high board fence, and contain long sheds for the reception of coal and other ashes, stowage room for sifted ash, poudrette, old coal, old bones and rags, boots and shoes and implements; also two rows of night-soil tanks,

capable of holding each at least twenty-three thousand gallons; large drying floors, and below the tanks a number of compost pits.

MODE OF HANDLING REFUSE MATTERS IN THE DUMPS.

We will now describe the method of handling and treating the refuse matters after reception within these depots. The ashes are dumped under the sheds, and then separated by the process of sifting from the coal, bones, rags, and other matters; and the vegetable and animal offal from houses, into the compost pits for after-treatment. The night-soil is dumped or pumped from the wagon-tanks into the first or upper row of tanks, after passing through a grating fixed in front thereof to separate from the ordure all stones, etc. As the contents of privy-vaults contain as a general thing a larger amount of urinous, than solid matter, the former rises to the surface, and when the upper tank is full, this supernatant liquor is decanted through long troughs, into the compost pits, containing the vegetable and animal offal, before referred to, and a percentage of sifted coal ash added to act as an absorbent and deodorant. The filling from the carts and decanting is carried forward until the first tank is full of solid, or rather semi-solid matter. This mass or residuum is then allowed to pass through a flood-gate into the second row of tanks, where sifted coal ash is added, which acts immediately as an absorbent and deodorant. Indeed, practical experience and observation have fully demonstrated that two thousand pounds of sifted coal ash will in fifteen minutes completely deodorize six hundred gallons of manure. The amount of sifted ash now ordered to be added to the ordure for the making of poudrette, is two parts of the latter to one of the former, or one of ash to two of night-soil, though for the purposes of greater strength and concentration for transportation purposes, one part of sifted coal ash may be added to three or four parts of night-soil, which makes a beautiful dry poudrette, and will, I doubt not, prove quite equal in its fertilizing qualities to the best guano, and far superior to many of the fertilizing agents now sold in the markets for from forty to sixty dollars the ton. The mixture thus made in the second row of tanks is, after deodorization, thrown out upon the drying floors about three inches deep, which, if the weather be favorable, will dry in a few hours. The mass is then removed and thrown upon a heap. A process of heating takes place, in which the great and small lumps or clods that were formed upon the drying-floor, fall or crumble into powder. The whole is then run through a sieve or screen, and is the fine or double refined poudrette, according to the capacity of the sieve, which is sold by the corporation of Baltimore for from fifteen to twenty dollars the ton, and its popularity is, I am informed, being well established with the farmers and gardeners who have used it upon their lands. This poudrette thus made from no other materials than the raw contents of privies and coal ash, is a fine dry, inodorous powder. The compost made from the kitchen offal, a portion of sifted ash, and the supernatant liquor from the manure tanks, is sold by the cartload of forty cubic feet or thirty bushels, at seventy-five cents, but it is an exceedingly rich manure, as can be well understood from its miscellaneous or heterogeneous character, being composed

of rich vegetable and animal matters. The old rags and bones are separated, as before stated, from the ashes, and also from the kitchen offal and night-soil, and sold, considerable revenue being derived therefrom. And the old boots and shoes can, I understand, be reduced to powder by the process of burning, and sold for the case-hardening of iron; the old coal, either sold for reburning, or for the making of roads. Thus it will be seen that the utilization of everything collected has been provided for, save the old pans and kettles, and we need not despair even of these, for it may be that ere long some branch of business will require them for useful purposes.

We have made no special reference to the utilization of the scrapings and sweepings of streets, because these generally find a ready sale; they, however, can, we doubt not, be made of greater value by admixture with the compost matters, as the supernatant liquor from the night-soil tanks is quite sufficient for complete saturation, even after these shall be added.

And now in bringing this paper to a close, we must beg to warn you not to be disheartened, not to be discouraged, when you read and examine the next annual report of the Health Department of the city of Baltimore, upon the utilization of the refuse of that city under the plan herein set forth. The system is yet in its infancy, having only been in practical operation a few months. We regret having been deprived of the privilege of engrafting upon it all our ideas of practical usefulness and economy. We think we may safely allege that the trial has proved a complete success, so far as the question of utilization is concerned.

REPORT ON DISINFECTION AND DISINFECTANTS.

By ELWYN WALLER, A. M., Ph. D.,

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The only reliable and certain method of disinfection implies a knowledge of the nature of infectious matter, and of the action of certain substances, known as disinfectants, upon that matter. These points are at present but imperfectly understood, and therefore at this time our knowledge of disinfection does not approach that certainty which is desirable. These problems are, however, being constantly investigated, and it is to be hoped that the necessary knowledge will soon be acquired. Some points have been established, and from these some conclusions may be drawn which may give assistance in solving the problem.

Diseases which are the effects of infection are known, and it is also known that infection is most frequent, indeed may be called an invariable accompaniment of decomposing animal and vegetable matter, chiefly the former, but the intermediate link, the nature of infection, is at present in the dark, and the various and widely differing theories of high authorities show how difficult the subject is.

Putrefaction, which is with good reason believed to be the direct source of infection, is considered to be synonymous with fermentation, the only difference being that the former is accompanied by a disagreeable odor, while the latter is not; the term putrefaction being believed to be really another name for putrid fermentation.

The labors of M. Pasteur have shown that fermentation is dependent on chemical changes induced by the presence and growth of microscopic germs derivable from the air; hence the theory has been advanced, and has met with general support, that infection consists in microscopic bodies floating in the air, endowed with vitality, any one of which on attaching itself to a spot favorably situated for its development germinates, and in producing others like itself produces derangement in such forms of animal life as offer favorable conditions for its growth.

Since the germ theory, so far as understood, does not agree perfectly with some facts which have been observed with regard to disease, a theory has been advanced, that though germs and the resulting microscopic organisms may be connected with infection, they are not the direct cause of it, but that by the changes which they produce, or which favor their existence, certain compounds are formed, which are in themselves the direct causes of disease.

Liebig propounded the theory that infection is caused by the presence of

decomposing matter in the air, ready to communicate its action in virtue of its own activity, and thereby cause decomposition and derangement.

Another theory very similar to Liebig's disregards entirely the intervention of microscopic organisms, and attributes infectious diseases to the presence of infectious matter of a gaseous character in the air, which may or may not be the results of putrefaction, while other theories take in some or all of these views as to the existence of agents conspiring to produce and spread infection.

A recent writer (V. Kletzinski) in discussing the disinfection question in Vienna with special reference to the epidemic of this last summer at that place, classifies the causes of diseases of this character under two heads, "miasms" and "contagions", and defines the first as poisonous gases rich in hydrogen, such as sulphureted hydrogen and ammonia, while "contagions" are described as germ cells. He further states that the contagions only flourish where miasms are developed. This last fact has been noted by many other observers, and under so many different circumstances that it may be regarded as unquestionable. It is a principle which should never be lost sight of, that whatever the nature of the infection may be, it certainly flourishes best where the conditions are most favorable, which conditions so far as known are fostered, if not directly afforded by the presence of decomposing matter. The old proverb about prevention and cure is nowhere more applicable than in this connection.

Dr. W. E. A. Erdt classes infectious diseases as — Volatile at all temperatures, Slightly Volatile, and Fixed. None are destructible below blood heat, while the majority are destroyed by a temperature of 112 to 140° Fahr.

Dr. Angus Smith supposes diseases to be caused, First, by gases easily diffused, and somewhat soluble in water. By passing gases from putrefying matter through cotton wool, and then treating the cotton with an alkali, he obtained an extremely offensive and possibly poisonous substance, apparently not containing organized life. Second, by vapors, volatile in warm, condensable in cool air, possibly containing organized germs. Third, by putrid and decomposing substances. Fourth, by organic bodies in various stages and ferments.

M. Davaine, in a report to the Paris Academy of Medicine, announces as the result of his and M. Onimus' reseaches, First, that the virus of infection is not an organized ferment. Second, that the lower organisms are the result and not the cause of putrid changes. This virus, he asserts, is not dialyzable, and hence is albuminoid in character. M. Davaine has extracted a substance from putrid blood, which he considers to be probably the virus of which he speaks, and has called it *septicemie.* A few drops of this substance injected into the veins of an animal were found to be fatal, but in the course of producing its effects on the animal it appeared to alter into a much more virulent poison, so virulent indeed that a trillionth part of a drop of blood from the animal first inoculated was sufficient to poison another, the animal rarely surviving forty hours.

From these, and numerous other experiments which might be cited, it will be seen how unsettled at present our knowledge is of the true nature of in-

fection. An attempt to decide in one way or another, brings one face to face with an array of facts which cannot be readily explained.

The means of combating infection — disinfectants — are of at least two kinds, according to their mode of action. 1. That of oxidation, which carries a decomposing body which would otherwise favor the production of infection so rapidly through its changes, as to prevent the formation of hurtful compounds or organisms. 2. That of arresting decomposition by some action as yet not thoroughly understood, but thought by many to be by coagulation of albumen. Dr. Angus Smith suggests that they may perhaps act by putting the molecules in such a state of tension as to prevent putrefaction.

Another class of substances act as driers, simply absorbing the water necessary to assist in the putrid changes. Such substances are chiefly efficient as antiseptics, and not as true destroyers of putrefaction and infection, and in their action as disinfectants, they run on the one hand into the class acting by oxidizing, and on the other hand into those producing the effects described under the second class.

Those substances which prevent putrefaction and sometimes perhaps arrest it by abstracting the oxygen required to keep it up, belong more properly to the class of antiseptics.

Of course such substances as only mask a disagreeable odor by a stronger and more agreeable one, cannot be considered in any sense as true disinfectants.

To effect oxidation many substances are employed, among which are water containing air in solution, constant supplies of fresh air, both of which require frequent renewal, inert substances in powder or finally divided, which condense air on their surfaces and also the noxious gases, thereby bringing the two into more intimate contact, and chemicals causing the liberation of oxygen, as chlorine and hypochlorites, permanganate of potash, peroxide of hydrogen, ozone, iodine, bromine, hyponitric acid, and the lower nitrogen oxides, chromates, etc.[1]

These substances act by oxidizing the carbon and hydrogen to the comparatively innocuous carbonic acid and water, but when the oxygen is exhausted they have no further effect, and putrefaction, if other conditions favor it, may begin anew, and reproduce the noxious compounds.

A little oxygen, sufficient only to foster putrefaction, is of course not a destroyer of infection, but large quantities, such as are supplied by comparatively small amounts of the above mentioned agents, are quite efficient.

It is usually recommended that disinfectants of this kind should be used in connection with those of the second class, that the odor and putrefaction may be destroyed at once by the first, and prevented from reappearing by the second.

Among disinfectants which act by arresting decomposition, have been enumerated carbolic and cresylic acids, creosote, thymol (a compound ob-

[1] Sulphurous acid may, under some circumstances, be placed in this category, though its action may be at other times reducing, from its tendency to form sulphuric acid, by taking up more oxygen. Its comparative instability tending in one direction or the other according to circumstances, renders it often efficient as a disinfectant, if the effects required are to be immediate and not permanent.

tained from oil of thyme), iron, zinc, manganese, copper and lead salts, and other more expensive ones, as those of mercury, arsenic, etc. Some mineral acids, chlorides, and nitrates, alkalies, and alkaline earths, and mixtures of these compounds, are recommended. Many of these have little or no disinfecting action, being rather antiseptics than disinfectants.

Of all of these cresylic and carbolic acids are generally believed, and with reason, to be the best. A mixture of the two is usually employed, since the separation is laborious and too expensive for obtaining an article sufficiently cheap for universal use.

Of disinfectants sufficiently inexpensive for general use (cheapness is desirable), next to carbolic and cresylic acids are placed zinc salts, and after them manganese and iron salts. The action of these substances upon putrid material has been the subject of much study, since by that means it has been hoped that the true nature of infection may be discovered. Those substances found to be most efficient have been observed to be agents which coagulate albumen, and hence as an outgrowth of the germ theory, combined with the fact that contagion and putrefaction, if not identical, require exactly similar conditions, the assumption was made that the germs causing infection or contagion contain albumen, which is essential to their existence. Hence, that what coagulates albumen, disinfects. This theory was promulgated by Dr. J. Hirsch, in 1869, but it will not account for all the phenomena of infection, and is therefore open to serious objection. It has been shown that cresylic acid, which is a more powerful disinfectant than carbolic acid, has not so much power to coagulate albumen. Dr. Angus Smith has also shown that coagulation of albumen though it retards, does not absolutely prevent, putrefaction. Moreover, it is stated that a solution of carbolic acid (one in one thousand) may be made, which though too dilute to coagulate albumen may yet disinfect. It may here be incidentally remarked that a sample of the Girondin disinfectant purchased during the past summer, and found by analysis to contain over twenty-one per cent. of zinc sulphate and about one per cent. of sulphate of copper, became in a short time spotted on the surface with a white mould, evidently of organic character, which leads irresistibly to the conclusion that the germs for that form of vegetable life, and therefore by analogy for perhaps others, do not depend for their existence upon uncoagulated albumen.

A commission of the Academy of Sciences in Paris, appointed to make an examination of the mode in which disinfectants act, reported that chlorine and the hypochlorites destroyed the gases, while carbolic acid destroyed the living agents of infection.

Dr. Calvert in experimenting on the relative efficiency of disinfectants as antiseptic agents with egg albumen, found that carbolic and cresylic acids, and powders prepared with them stood first, chloride of zinc next, and next to that chloride of lime; chloride of aluminum was found to be among the lowest in the scale of those tried.

In another series of experiments, accompanied by microscopic examination, he found that while in an untreated solution of blood, the vibrios increased steadily, — cresylic acid destroyed them entirely, carbolic acid,

quinine sulphate, chloride of zinc, or sulphuric acid destroyed nearly all (a few nevertheless remaining); chloride of aluminum, sulphurous acid, and prussic acid at first destroyed them, but they afterwards reappeared. Chloride of lime, chloride of mercury, caustic soda, nitric acid, sulphate of iron, and acetic acid also destroyed some at first and then favored the development of what remained. Arsenious acid, salt, chloride of calcium, and sulphate of lime had no effect, while lime, charcoal, permanganate of potash, and ammonia actually favored their formation.

If the germ-theory is accepted in connection with these results, most substances believed to be efficient in disinfection must be discarded, or else the germs causing disease require different conditions of life to what the microscopic organisms already known, stand in need of.

Dumas states that carbolic acid acts by arresting the decomposition of albuminous matter, and secondly, by killing the germs formed. He recommends the use of carbolic acid in conjunction with chloride of lime for disinfecting purposes.

Junghaus states that carbolic acid when tried on the battle fields in France did not disinfect, but only retarded putrefaction, while Wiederholt and others claim that it is the only true disinfectant. A comparison of these views with the results obtained by Dr. Calvert, renders it probable that some of the properties of cresylic acid have in some cases been attributed to carbolic acid, since the difficulty of perfectly separating the two would render such a mistake very natural.

Many of the disinfectants enumerated, destroy or precipitate sulphureted hydrogen and sulphur compounds allied to it; perhaps among such compounds those which render the emanations from putrid matter so dangerous. Magnesium salts, and some other compounds, remove ammonia, which also accompanies putrefaction, but the question may fairly be raised whether this is not doctoring the symptoms rather than the disease, sulphureted hydrogen and ammonia being the invariable accompaniments of putrefaction.

In general it is recommended that disinfectants should contain no free acid, as that tends to set free sulphureted hydrogen, and increase the disagreeable odor, if it does not free other and more deleterious compounds.

Many objections have been raised to the disinfectants at present in use. Wiederhold takes the following exceptions to them. Permanganate of potassa is easily decomposed, giving up its oxygen to organic matter whether hurtful or not, and moreover to be effective must be used in large quantities. Chlorine, and chlorides of lime and the alkalies are dangerous to those having weak respiratory organs, while carbolic acid is stated to be only effective when used concentrated, and then it has an unendurable smell. Some of these objections are valid; but it is certainly much better to endure some inconvenience than to run the risk of greater evils.

Infection may possibly exist without affording any appreciable odor; so that we cannot be certain when the noxious elements are destroyed, yet so far as our knowledge goes almost the only test we can apply is the presence or absence of odor, which shows whether putrefaction is going on or not, and is therefore to some extent uncertain. Thus much is certain, however, that

sulphureted hydrogen and other ill-smelling sulphur compounds, as well as ammonia, always accompany putrefaction from which the most danger in the way of infectious diseases is to be apprehended. Sulphureted hydrogen and ammonia though in themselves unwholesome, are entirely powerless to produce quickly in one's system the derangements of the class, or of the character produced by what we term infection. In conducting the experiments I have made I have accordingly made the removal of odor the tests of the efficiency of the various disinfectants, and as will be seen the results correspond with those obtained by other experimenters who have applied not only the test of odor, but have supplemented it by a microscopic examination.

Experiments on Disinfectants. — The disinfectants examined may be classed as I. Inorganic preparations. II. Carbolic acid (liquid) preparations. III. Various powders containing carbolic acid in some form.

I. Inorganic Preparations.

Monsel's Solution, containing 30.44 per cent. sulphate of sesquioxide of iron, and 5.98 per cent. nitrate of sesquioxide of iron with some free acid.

De Wessely's Solution, containing 4.53 per cent. protosulphate, and 14.34 per cent. protochloride of iron, with 8.74 per cent. chloride of zinc.

Liquid of Manhattan Metal and Chemical Company, containing about 5.8 per cent. protochloride of iron, and 21.52 per cent. chloride of zinc, besides small amounts of other substances. Two samples of the *Girondin Disinfectant*, containing respectively, about 20 and 22 per cent. of sulphate of zinc, and about 1 per cent. of sulphate of copper each.

Hovey's Chloride of Zinc, containing 12.47 per cent. chloride of zinc.

Coutaret's White Fluid, containing 7.37 per cent. sulphate of zinc.

Seeley's Sulphate of Manganese, containing 10.06 per cent. sulphate of manganese, 4.93 per cent. sulphate of sesquioxide of iron, and about eight per cent. of free hydrochloric and sulphuric acids.

Chloralum (the English preparation), containing 13.21 per cent. chloride of aluminum.

Bromochloralum, containing 8.15 per cent. chloride of aluminum with small amounts of bromide besides lime salts.

Crude Protosulphate of Iron (solid), containing 53.2 per cent. pure anhydrous protosulphate.

Excelsior Disinfectant (solid), containing 7.8 per cent. flowers of sulphur, 31.5 per cent. protosulphate of iron, 19.25 per cent. common salt. The whole perfumed with a little oil of cassia.

Darby's Prophylactic Fluid, containing 0.055 per cent. permanganate of potash, and 9.59 per cent. other potash salts, chiefly the carbonate.

Le Doyen's Disinfectant, containing 11.63 per cent. nitrate of lead.

Labarraque's Solution of chloride of soda, containing about 1.5 per cent. available chlorine.

Chloride of Lime, containing about thirty per cent. available chlorine.

II. Liquid Carbolic Acid Preparations.

Of these, those samples classed as "crude carbolic acid," or "Dead oils," will not be mentioned in this place, as I will give in another place the com-

parison of their disinfecting properties with the percentages of carbolic acid determined approximately by the degree of solubility in water.

Of other liquid carbolic acid preparations there were —

Grantville Carbolic Alkali. — A potash solution of crude carbolic acid, containing 1.86 per cent. potash, and about four per cent. carbolic acid.

Phenol Sodique, manufactured in Philadelphia after the specification of a French method, consisting of a weak soda solution containing about one per cent. carbolic acid.

Metropolitan Disinfectant.[1] — Mixture of solution of protosulphate of iron and dead oil, contained 11.4 per cent. protosulphate of iron, and about three per cent. of carbolic acid.

III. — Solid Carbolic Acid Preparations.

Carbolate of Lime. — King, Hoagland, and Woodruff, 64.24 per cent. lime, 0.6 per cent. magnesia. The remainder being carbolic acid, dead oil, and impurities of the lime.

Carbolate of Lime. — Nichols, Boston. 58.34 per cent. lime, 3.78 per cent. magnesia. The remainder as before.

Carbolate of Lime. — Grantville, two samples. 53.93 and 50.41 per cent. lime, about 1 and 3.83 per cent. magnesia. The remainder as before.

Phœnix Disinfectant. — Containing 56.88 per cent. clay, 7.68 per cent. oxide of iron, the remainder consisting of impurities of the clay and dead oil.

Egyptian Disinfecting Powder. — Containing 88 to 89 per cent. of tolerably pure clay, the remainder consisting of moisture and dead oil. By means of ether, 6 per cent. of dead oil was extracted.

Granulated Disinfecting Powder, consisting of sawdust soaked in dead oil. From the tests made upon this it appeared to contain about 70 per cent. or more of sawdust.

EXPERIMENTS ON INORGANIC DISINFECTANTS.

Two pounds of dried blood (such as is used by sugar refiners under the name "spice"), were dissolved in eight times their weight of water, and the solution set aside for a few days until it had become putrid. Of this solution one hundred cubic centimetres were then taken for each disinfectant, and a measured quantity of the disinfectant added until apparent disinfection had taken place, or when that was not the case the addition was stopped when a volume of the disinfectant equal to that of the blood (one hundred cubic centimetres) had been added. During and after such addition, the bottles were shaken to thoroughly incorporate the mixture; they were then closed with plugs of cotton, set aside, and examined daily for twenty-five days, and after that at longer intervals, the experiments being continued for sixty-six days in all. With the metallic solutions the carbolic alkali was also tried in order to form a standard of comparison.

[1] Not the true Metropolitan Disinfectant, which consists of a mixture of dead oil and sesquichloride of iron. Mixtures of the nature of the above were put up and sold as "disinfecting solutions" by several druggists in this city during the past summer, who charged twenty-five to thirty cents per quart for the mixture.

It must be borne in mind that in working over considerable quantities of putrid material, the sense of smell upon which I was obliged to rely, was necessarily much blunted, so that deodorization was apparently caused in most cases where an examination the next day showed that it had probably not been complete. This remark may be necessary to explain the statements in the tables, where, for instance, fifty or sixty cubic centimetres of the disinfectant was added, until as above mentioned apparent deodorization had been effected, though subsequent examination did not show that permanent deodorization was effected until after thirty or forty days. The deodorization is designated as "permanent" when the odor of putridity did not reappear during the experiment.

TABLE I.

Solution used.	Amount of Disinfectant used c.c.	Phenomena observed with regard to Odor during Sixty-six Days.
Grantville Carbolic Alkali	4.5	Odor almost completely destroyed at once, a stale odor remaining.
De Wessely's	20.5	Permanent deodorization in 23 days.
Seeley's Sulphate of Manganese, first sample	44	Permanent deodorization in 17 days.
Manhattan Metal and Chemical Co.'s	100	Permanent deodorization in 23 days.
Hovey's Chloride of Zinc	65	Permanent deodorization in 39 days.
Contaret's White Fluid	100	Permanent deodorization in 39 days.
Le Doyen's Disinfectant	100	Permanent deodorization in 39 days.
Girondin, first sample	100	Deodorized in 39 days, a faint putrescent odor appearing just at the end of the experiment.
Girondin, second sample	100	Permanent deodorization in 39 days.
Chloralum	100	Permanent deodorization in 60 days.
Bromochloralum	100	Odor somewhat diminished, but not removed.
Labarraque's Chloride of Soda . .	22	Putrid odor, at first replaced by that of chlorine, which was soon gone, the putrid odor rapidly reappearing.
Darby's Prophylactic	48	Odor at first destroyed, returned more rapidly than with Labarraque's solution.

Comparatively cool weather, especially when clear, rendered the putrid odor less marked in all cases, which makes it probable that if the experiments had been conducted at a cooler season, instead of during the warm months of August and September, deodorization would have been more rapid.

These experiments show the rapid action of oxidizing disinfectants with their subsequent loss of power, and the comparative slowness of the action of metallic salts, which act by arresting decomposition.

In Dr. Angus Smith's experiments on the comparative efficiency of various compounds when used as disinfectants in three different series, while the other substances remained the same, chloride of zinc appeared to vary

in its action, forty parts being necessary in one case where only fifteen were required in another.

In the above results a similar variation may be observed by a comparison of the effects produced by the disinfectants containing zinc salts, and the results obtained by analysis of them, though a mixture of iron and zinc salts appears to be more efficacious than zinc salts alone.

Chloride of Aluminum, as in other experiments on record, stands low. The bromine in the Bromochloralum not being free, did not apparently improve the powers of that disinfectant; the amount was probably too small to have any effect unless it were free.

Sulphate of Manganese stood very well, though containing considerable free acid. Manganese salts are by no means so plentiful or so cheap with us as in Europe. They would doubtless prove very efficient, to judge from the sample experimented upon.

Nitrate of Lead, though from the chemical properties of its constituents it was argued ought to stand very high, does not appear to answer the expectations formed regarding it. I have found no record of experiments with it.

In order that a better estimate of the comparative value of the disinfectants might be formed by the use of the same amount in each case, a second series of experiments was made, one hundred cubic centimetres of the solution of putrid blood being taken for each disinfectant as before, and ten cubic centimetres of the disinfectant added, the mixtures being treated as before.

Besides the disinfectants in solution, five grammes of the Excelsior Disinfectant and five grammes of solid crude Protosulphate of Iron, as well as one gramme of the same protosulphate dissolved in about eight or ten cubic centimetres of water, were also tried, one hundred cubic centimetres of putrid blood being used for each.

The results were as follows: —

TABLE II.

Comparative Efficiency of Disinfectants, ten per cent. of each being used.

Disinfectant.	Phenomena observed with regard to Odor during Sixty-six Days.
Grantville Carbolic Alkali	Faint odor of carbolic acid mixed with a stale odor throughout.
Monsel's solution	Permanent deodorization in 21 days.
De Wessely's	Permanent deodorization in 23 days.
Liquid of Manhattan Metal and Chemical Co.	Permanent deodorization in 40 days.
Seeley's Sulphate of Manganese	Permanent deodorization in 40 days.
Girondin, first sample	Permanent deodorization in 40 days.
Girondin, second sample	Permanent deodorization in 40 days.
Hovey's Chloride of Zinc	Putrid odor faint in 18 days. Deodorization in 66 days.
Coutaret's White Fluid	Putrid odor scarcely perceptible in 18 days. Deodorization in 66 days.

Disinfectant.	Phenomena observed with regard to Odor during Sixty-six Days.
Chloralum	Putrid odor faint in 25 days. Deodorization in 66 days.
Le Doyen's	Faint putrescence and staleness apparent at end of 66 days.
Crude Protosulphate of Iron (five grammes solid)	Odor diminished, but remained more marked than with preceding.
Crude Protosulphate of Iron (one gramme in solution.)	Putrid odor decreased for about a week, then remained quite perceptible for some six weeks, after which it began to increase.
Bromochloralum	Odor diminished slightly, but perceptible putrescence throughout.
Excelsior	Action like that of the one gramme crude protosulphate of iron.
Labarraque's Solution	Partial deodorization at first, the bad odor soon returning.
Darby's Prophylactic	Effect very slight, bad odor soon returned.

The order of efficiency of the disinfectants is about the same as in the previous table. The contrast between the effects produced by the addition of five grammes of solid protosulphate of iron undissolved, and the one gramme in solution, shows that when in solution, as might be anticipated, the action of this salt is more rapid, but that after a short time the solid probably dissolves, and shows its effects. Moreover, five per cent. of this salt is insufficient to deodorize putrid blood even in two months, and indeed if an insufficient quantity of disinfectant is used, a point is reached where it ceases to act, and the putrefaction recommences. Of the oxidizing disinfectants, permanganate of potash and chloride of soda, enough was not added to effect complete deodorization, and putrefaction again set in more rapidly with the former than with the latter.

A comparison of the results in the two series as to the time in which permanent deodorization was effected (at least which I term permanent, since the putrid odor did not reappear up to the end of the experiment), shows that the effects produced are not proportional to the amount of disinfectant added, so that in some cases, beyond a certain point, further addition of a disinfectant is mere waste of material.

In trying the effects of the samples of carbolic acid, the results obtained with the "Carbolic alkali" led to the supposition that ten per cent. would be too large an amount to use and obtain good comparative results. It was therefore decided to use one quarter of that proportion. Accordingly two hundred cubic centimetres of the putrid blood were taken for each sample, and five cubic centimetres of the sample added, the bottles shaken, stoppered with cotton, set aside and examined as before. With these samples two points were noted particularly. The carbolic acid destroyed the odor in a longer or shorter time, in some cases, however, leaving the solution with no definite odor, and after some time, though sometimes immediately, the odor of the carbolic acid or dead oil made its appearance. The times of such disappearance of putrid odor, and appearance of that of carbolic acid, are noted in the

table. The samples were tested for their contents in carbolic and cresylic acids by shaking them up with a large quantity of water, and measuring the amount which did not dissolve, carbolic and cresylic acids being soluble in water to some extent.

TABLE III.

Samples labeled.	Percentage soluble in water.	Odor when set aside.	No. of Days elapsing to loss of putrid odor.	No. of Days elapsing to appearance of odor of Carbolic Acid.
Calvert's No. 5 Carbolic Acid	98.	Faint Putrescence	7	7
Squibb's No. 1 Impure Carbolic Acid .	82.4	" "	6	6
Carbolic Acid, No. 2 Warren Chem. Co.	80.4	Decided Putrescence	20	23
Carbolic Acid, Armstrong	70.8	" "	17	24
Carbolic Acid, No. 1 Warren Chem. Co.	69.2	Of Carbolic Acid	11	23
Dead Oil, Warren Chem. Co.	66.2	Faint Putrescence	10	10
Carbolic Acid, Warren Chem. Co. . .	64.	" "	12	24
Dead Oil, Warren Chem. Co.	64.	" "	16	16
Carbolic Acid, Warren Chem. Co. . .	60.8	Perceptible Putridity	12	25
Squibb's No. 2 Impure Carbolic Acid .	57.6	Of Carbolic Acid	0	0
Dead Oil, Warren Chem. Co.	46.4	" " "	11	23
Edey's Crude Carbolic Acid	42.4	" " "	0	0
Dead Oil, Warren Chem. Co.	34.	" " "	0	0
Kidder, Wetherell, & Co., Carbolic Acid	34.	None	0	1
King, Hoagland, & Woodruff, Carbolic Acid	26.	Perceptible Putrescence	9	21
Crude Carbolic Acid	26.	Faint Putridity	13	54

The above-mentioned consisted only of carbolic acid more or less rectified. A few of the liquid carbolic acid preparations contained some other substance besides carbolic acid, as alkali or protosulphate of iron. These were also tested in the same manner, with the exception that the water solution and that containing protosulphate of iron were tried on one hundred cubic centimetres of putrid blood instead of two hundred cubic centimetres, the amount used with the others. The results were as follows: —

Name of Disinfectant.	Phenomena observed with regard to odor during Sixty-six days.
Phenol Sodique	Odor diminished, but quite perceptible throughout.
Grantville Carbolic Alkali	Essentially the same as the above, a slight ammoniacal odor being perceptible.
Squibb's Water Solution of impure Carbolic Acid	Some putrid odor perceptible throughout.
"Metropolitan Disinfectant"	Putrid odor at first diminished, then increased.

In this series of experiments the disinfecting power of the samples does not appear to be so closely corresponding to the percentage of carbolic and cresylic acids as determined by the degree of solubility in water; a difference in the relative proportions of carbolic and cresylic acids, the latter being much the most efficient disinfectant, may have much to do with this. The presence of small amounts of alkali in the samples would render a larger proportion soluble in water, and moreover from an experiment tried in the laboratory, it appears that carbolic acid will itself hold about twenty per cent. of water, and might probably mix in that state with the other constituents of the tar from which it was derived, so that one or both of these causes might vitiate the test by solubility in water.

Sesquichloride of iron, which gives a fine purple coloration with water solutions of carbolic acid, is often used as a means of determining the percentage of carbolic acid, but the coloration is so readily affected by the presence of minute quantities of other constituents of the tar, and by salts of all kinds, that it is not to be relied upon for accuracy.

In testing the solid preparations containing carbolic acid, five grammes of each were taken, shaken up with one hundred cubic centimetres of putrid blood, the odor noted, the bottles stoppered with cotton, set aside and examined as in the previous experiments. One hundred cubic centimetres of putrid blood was also shaken up with five grammes of partially slaked lime, in order to determine if possible whether any or all of the deodorizing properties of the disinfectant were to be attributed to the lime in the samples, the majority of them being the so-called carbolates of lime.

The results were as follows : —

TABLE IV.

Disinfectant used.	Phenomena observed with regard to Odor during Sixty-two Days.
Lime (partially slaked)	Putrid odor gone in 21 days, returned at the end of 50 days.
Carbolate of Lime, — King, Hoagland, and Woodruff	Putridity gone in 19 days, being superseded by the odor of carbolic acid.
Nichols' Carbolate of Lime	Putridity gone in 37 days, the odor of carbolic acid taking its place in a short time.
Grantville Carbolate of Lime, second sample.	Putrid odor decreased slowly, not having disappeared entirely by the end of the experiment.
Grantville Carbolate of Lime, first sample .	Odor almost entirely removed in 37 days, after which it gradually returned.
(In all of the above samples the first addition of the disinfectant developed a strong odor of ammonia, which gradually disappeared.)	
Granulated Disinfecting Powder	Odor diminished perceptibly but not entirely removed.
Phœnix Disinfectant	Very slight diminution in putrid odor.
Egyptian Disinfecting Powder	Same as the above, an increase of putrid odor being observed toward the close of the experiment.

From these experiments it appears that the carbolates of lime owe their disinfecting properties, what little they possess, largely to the amount of slaked lime which they contain. Those which had absorbed most carbonic acid appeared to have the least effect. The lime alone appears to have considerable effect at first, but as might be anticipated, gradually loses ground by prolonged action.

As general conclusions from this examination of the disinfectants sold in our city, it may be affirmed that by far the best disinfectant of all is carbolic acid, and of metallic or inorganic preparations, zinc salts, or a mixture of zinc and iron salts, nitrate of sesquioxide of iron and manganese salts are most efficient.

For immediate disinfection and deodorization, some oxidizing agents, as chlorine, chloride of lime, or permanganate of potash should be employed, but as these soon exhaust themselves, some metallic solution should follow their application to prevent the return of infection.

"Carbolates of Lime" and powders containing carbolic acid usually contain so little carbolic acid as to be of comparatively little use as disinfectants. Those containing no lime are the least efficient. Those containing lime lose their efficiency when allowed to absorb carbonic acid from the air.

With putrefying material, which may favor the development or spread of infection, at least one per cent. of carbolic acid may be required to arrest such putrefaction, though much less than one per cent. will no doubt act as an antiseptic provided putrefaction has not already commenced.

VIII.

GENERAL SANITARY LAWS. STATE AND LOCAL ORGANIZATION FOR SANITARY ADMINISTRATION.

GENERAL HEALTH LAWS AND LOCAL ORDINANCES, CONSIDERED WITH REFERENCE TO STATE AND LOCAL SANITARY ORGANIZATION.

By ELISHA HARRIS, M. D.,
Of New York.

The framing and administration of sanitary laws and regulations in the various states and municipalities of North America, should conform to the somewhat various and changing conditions of the areas and methods of the civil government. Cities and large villages thoughout this continent maintain as strict independence as they possibly can in affairs of their local government. This, and other circumstances may tend to delay the enactment of general laws or a general sanitary act in numerous States. But such general laws can readily be obtained in each State in which the friends of sanitary improvement cordially agree upon the points that should be attained, and upon the most economical and effectual methods of administration, by which the desired results may be accomplished.

A central source of information and of advisory, as well as ultimate authority, should be created and put into operation in connection with local authorities. Hence it is, that we witness now the working of the Boards of Health under general sanitary laws, as well as good local sanitary organization, in some of the newest of our States, as in Minnesota and California. New machinery of government may be more readily adjusted than old parts, recast, can be adjusted or harmoniously worked. Thus, in some respects, the friends of sanitary improvement in the newer States may be the first to succeed in their efforts.

As the progress of sanitary improvement plainly requires that there shall be an effective system of State organization and a new and well regulated method of local sanitary administration, health laws, like the laws and regulations relating to the peace of communities or to the education of the people, the development of local improvements, or the protection of towns and districts against trespass and nuisance, are found by experience to be useful, acceptable, and well administered in proportion as the inhabitants of

the communities are intelligently concerned about the causes for which such laws and regulations have been called into existence. This is true, in general terms, in any country, and in the United States this truth is practically more important, and has fewer exceptions, than in most other countries.

Sanitary cordons and the regulations of the government authorities of Europe, whenever confronting the march of cholera and other pestilences, have proved unavailing except as particular communities conformed to and applied the sanitary regulations intelligently. And even now, when the diffusion of the cholera from India and Persia seems to be effectually obstructed by the practical application of sanitary regulations in the Hadjez and along the routes traversed by the Mohammedan pilgrims, and also upon the frontiers of the Turkish and Russian dominions, the only real security against the onward march of this and other infectious pestilences lies in the intelligent support of the local and general health laws by municipal and State authorities who understand and can explain what are the reasons and uses of the regulations which they enforce.

Previously to the diffusion of popular information concerning the common principles and explanations of sanitary regulations in regard to the preventable causes of cholera, the enforcement of the regulations produced panic, frequently followed by brutal violence and scenes of terror, among inhabitants who utterly misunderstood the nature and purpose of the sanitary measures intended for the repression of the pestilence.

This lesson from experience may be useful when brought home to enlightened communities in regard to any thorough and general application of the machinery of government and local authority for adopting and enforcing regulations designed to protect the public health, and promote the sanitary welfare of towns and cities. It was of the ignorant and most needy sufferers from insalubrious conditions that John Simon, the chief medical officer of the Privy Council of England, spoke when he said, ". . . . beyond all measure hopeless is the wish that persons thus circumstanced should ever in other respects aspire to that atmosphere of civilization which has its essence in physical and moral cleanliness." The wretched denizens of the very purlieus of pestilence in the slums of neglected cities and large towns; the inhabitants of malarial districts; households that are being wasted by phthisis; citizens while inhaling the poisonous emanations of foul sewers and cesspools, or suffering exposure to small-pox and typhus; and entire communities drinking the water from defiled streams, or partaking of diseased meats and adulterated condiments, all alike would cry out against the invasion of their personal rights, if general laws or arbitrary local regulations were to be applied against the pleasure and conceits of the sufferers, to secure their sanitary welfare without their first understanding the necessity and reasonableness of the duty of such wholesome interference. Though it may be God-like to save, to rescue, to overrule and compel the safe escape of human beings that would suffer and miserably perish without such interposition; though there be just pride in the manly prowess that rescues the drowning, the wrecked, and the helpless from the peril of impending death, and although there is

a confessed sublimity in the uncompensated and faithful study and toil of devoted physicians as officers of health who by the application of their definite knowledge and skill arrest the progress and ravages of a pestilence, or prevent the operation of any great source of disease, these less frequent duties and acts of the "savers of men" must not be mistaken for the chief and constant functions of sanitary officers and health government; for they are savers of men and of great moral interests of society by preventing the operation of causes which destroy life and health.

All experience seems to warrant the conclusion that, in the United States, *the permanent value and success of any methods or system of sanitary government will depend upon the degree in which the people are generally enlightened, concerned, and made responsible, in regard to sanitary duties.*

With this fact clearly in mind, and a definite view of the practical effects of good laws and regulations as agencies for promoting a definite knowledge of obligations and securing a dutiful compliance with such laws, we proceed to examine the most important questions relating to the administration of sanitary laws and regulations.

PRACTICAL POINTS TO BE KEPT IN VIEW.

I. *The Areas of Administration:* As indicated by the nature of the duties to be performed by the sanitary authorities, and the requisite conditions for success of the duties, as defined by existing and progressive social and governmental organization in the States, cities, and towns to be affected.

II. *The framing of certain General Laws, and the establishment of a central or State Board of Health in each State:* For giving a systematic and enlightened direction to the sanitary administration, and to secure practical results and thoroughness in the application of general laws relating to the public health and vital statistics.

III. *The adaptation of methods of local administration best designed to secure popular support, and the effectual application of sanitary laws and regulations:* This result to be sought by the encouragement and prudent aid to local administration, and the avoidance of unnecessary assumption of any local duties, or interference with local officers, without specific cause, by the State Board of Health.

IV. *The public influence and economy of a State System of Sanitary Administration:* To be attained through good results witnessed and approved under the local authorities, and through the local and general inquiries and reports instigated by the State Board, and by such gain to life and health as can be ascertained through the system of vital statistics.

Practical ends that should be attained under the Local Administration, whatever the system: Mutual support of the State and Local functions in the Sanitary Administration.

CONCLUSIONS AND SUGGESTIONS.

Areas of Sanitary Administration. — Every State government, by its legislature, owes to the total population the enactment and provision of laws and

methods that shall be adequate to protect the general health of the people against those causes of sickness and mortality that cannot be adequately restrained without general provisions of law which shall either prescribe methods and proceedings, or require local authorities so to prescribe and proceed for the proper removal and prevention of unnecessary cause of danger, and injury to life and health.

The individual, the family, the employer, the hamlet, the town, and every city, has each its own responsibility and duty in avoiding and preventing injury to life and health. And were every individual, and each neighborhood and community properly informed, vigilant, wise, and dutiful, in the prevention of such injury, there would be a speedy and universal observance of all the laws of health and personal safety as respects individuals, dwellings, villages, and cities.

But still there are more widely extended and general causes of injury and peril to the public health which can be effectually controlled only by general laws and regulations, that shall provide methods and prescribe duties to be enforced by the proper authorities. This fact requires State enactments, whether in the nature of general laws defining the local and general obligations, or in the nature of a supreme central authority. It is necessary, therefore, that there should be a general statute relating to the organization and duties of boards of health, and that the *General Sanitary Act* shall specifically require that every *township or every county* shall organize a local Board of Health, to give effect, as far as necessary, to the requirements and duties under the General Act. There is much reason to believe that the county area and the established and permissible methods of county administration, in most of the American States, will constitute the most natural and acceptable *unit* — geographically and civilly — for the local sanitary administration of communities; and that towns and villages will, in most of the States, quite naturally and effectively organize and administer their own respective health duties in connection with — often as parts of — the county system. One thing is certain, namely, that there should be thorough organization upon that civil and geographical basis which will afford greatest facility of efficient sanitary duties, and in the settlement of questions that may involve general expenditure, and some form of general authority for protecting the public health. This is witnessed in the duty of applying measures for protection against small-pox, and some other diseases, and for securing necessary drainage of malarial districts, the preservation of sources and of the purity of water supply, etc.

The geographical extent and civil competency of the *primary areas* of sanitary administration will be found to have an important bearing upon the final success and economy of sanitary improvements.

That the areas of sanitary administration — as regards the several branches and purposes of the public health service — should correspond with the best arrangements of the civil government of town, village, county, and State, would seem to require no argument; but we may properly urge that in respect of all duties which relate to the prevention of general causes of disease, the spread of contagious and pestilent maladies, the provision

for and the supervision of vaccination, the application of quarantine or any restrictive sanitary regulations, the sanitary management of general drainage, and the supervision of returns and registration of Vital Statistics, the *areas of administration* should be determined by those limits and considerations which will secure the most perfect results and the largest degree of popular and intelligent support from the people.

While it cannot be denied that if there were no existing boundaries and definitions of the areas or districts in which political or civil administration has certain defined limitations, it would be well if the areas in which sanitary laws are to be separately administered were defined with reference to natural sanitary outlines and necessities, we must, as matters of civil and municipal administration now stand, conform in some degree to those primary organizations of the people which already exist. Hence it is that the city, town, and county precincts inevitably become for the present the most convenient primary areas of administration. If, however, no general sanitary supervision and authority exist in a State, the local administration of health laws would frequently fall far short of securing general protection of the people of the State against preventable causes of pestilential diseases. In the absence of unity of purpose and methods in the sanitary service of different municipalities and counties, one of the local administrations might be doing much to protect itself, while it actually drove outward into other localities infected persons and materials to imperil all portions of the State whither they went. This, indeed, is but the lesson of experience; we have seen bedding and clothing which the sick and dead of small-pox, fever, and cholera had left behind them in care of the local sanitary authorities, sold and conveyed beyond the jurisdiction of such officials, and thus putting in jeopardy communities more populous and less carefully protected. It may be laid down as a safe postulate, therefore — That the reasons which require vigilant and specific local sanitary duties to be performed, likewise require that there should be central sanitary organization adapted to give any necessary counsel, aid, and authority to the local boards of health.

STATE ORGANIZATION ESSENTIAL TO LOCAL EFFICIENCY.

Practically considered, the chief benefits from sanitary government will be insured most completely and permanently only when and where the masses of the people become interested, and will aid in giving such success. This, however, does not imply that each hamlet and town, much less that every little neighborhood should be left to itself, to become a nest of pestilence, or to produce cretans and consumptive paupers, by neglecting sanitary obligations that concern the county and the State. It was of the debased and ignorant sufferers from neglected drainage and cleanliness, and from domestic insalubrity, that Mr. Ruskin wrote when he exclaimed, " . . . . They resist every effort to lead them into purity of habit and habitation, and to give them wholesomeness of air, as new interference with their liberty, ... insisting on their right to helpless death." Such pestilence-breeding neighborhoods or premises must be brought under saving sanitary regulations. County and State sanitary authorities need to be

required, under General Health Laws to coöperate in giving any necessary enforcement to such regulations in any community, place, ground, or building that seriously endangers the public safety or the health and welfare of defenseless persons.

The duty and adequate authority to organize the Local Boards of Health, and to administer the various and proper functions of such Board, being conferred upon the "supervisors," "chosen free-holders," or other chief civil authority in the county (or in the town, or in the incorporated village, as the case may be), the central Board of Health of the State should be adapted and required to give completeness and efficiency to Health Laws.

THE REGISTRATION OF VITAL STATISTICS.

The maintenance of a proper system of Registration of Vital Statistics in the State requires that the primary returns of such statistics in every county, and, if practicable, in every town, should be supervised by the local sanitary authority. It is our duty to urge this function upon local sanitary authorities, and upon the States that have not yet organized a system of Vital Registration. It is confessed to be the special want, now, of the English Registration system. It is obviously the want of the State systems, thus far, in our country. The original vouchers, and the methods of the records for public registration of Vital Statistics need to be under the skilled supervision of the local sanitary authority, near to the sources of such vouchers and records.

The final and central revision of the State Registration of Vital Statistics should be supervised by the State Board of Health, and, through the agency of that Board, the most directly useful purposes and publicly important information of the Registers should be sought and published. Whether the State system of Registration is treated as a bureau of the Department of the Secretary of State or otherwise, still it needs the supervision of expert officers of public hygiene. The local registration especially requires such supervision, and no methods of vital registration will be satisfactorily correct, as respects the records of diseases and mortality, unless such local as well as central supervision is provided.

Uniformity in practice, and comparable results, can be secured in the methods and system of registration of Vital Statistics, and of the records of disease and of epidemic phenomena throughout all the States of North America whenever each State has a central Board of Health with reasonable supervisory authority over the Vital Registration. Such uniformity is greatly to be desired, and it appears to be the duty of all such sanitary authorities, in the United States, as already direct the public registration of Vital Statistics, to agree upon this duty of giving the highest practicable degree of uniformity to the methods and periodical abstracts of their registration.

DEFINITION OF AND PROCEEDINGS AGAINST NUISANCES.

The abatement, control, and prevention of *Nuisances* being uniformly recognized as a duty of sanitary authorities, it is desirable that in each state and city, and in all sanitary acts and codes there should be a reasonably

uniform and strictly correct specification and definition of the term "nuisance" and its special applications in health government. Evasion of the duty of obedience to sanitary laws, and the injurious perpetuation of nuisances detrimental to health and life, will become less and less frequent whenever there are positive definitions and specific declarations of nuisances against health, which, in every community, shall be abated and prevented. The power and duty of the Board of Health to announce the presence and order the removal of whatever it finds to be a nuisance, should be undisputed, but the people generally must be allowed ample opportunity to understand the reasons and nature of the proceedings against nuisances. The provisions of a sanitary code ought not to be arbitrary. The importance of inciting the interest, inquiry, and support of the people, in proceedings against nuisances, should be understood by the legislative authorities or persons who frame the sanitary laws and ordinances. The provision that should be made in every sanitary code to give patient and sufficient "*hearing*" to persons prosecuted or enjoined under the health laws, should be so framed and so applied as to become a means of publishing the most important kinds of sanitary information and evidence.

POPULAR INSTRUCTION IN PHYSIOLOGY AND HYGIENE.

Instruction in human physiology and hygiene in the course of public school education and in all colleges and seminaries, would conduce to the prevalence of public regard for sanitary duties. Teachers of the public schools should be required, under the State laws relating to public health as well as those relating to public instruction, to sustain an examination in physiology and hygiene. The local boards of health should have authority to inspect all school-rooms, and to advise with the boards of education concerning matters affecting life and health.

The State and local boards of health should be required by law to make a faithful sanitary inspection and inquiry in every hospital, medical dispensary, asylum, reformatory, and penal institution every year, and as much oftener as circumstances may warrant; and such inspections and duties should be carefully supervised in some degree by the State Board of Health aided by counsel or information given by the State Board of Public Charities. A chapter in each yearly report of the health boards, — state and local, — should comprise a careful statement of results, etc., in this class of duties.

The usefulness, dignity, or permanent influence and success of the local sanitary authority will be promoted if the State authority and aid can be extended to the local officers, when proper, in matters of local inspection and inquiry upon subjects of general as well as local interest. The purpose and duty of harmonious coöperation between the State and local boards should be obvious to the people. By such influences may the people be kept interested in the sanitary duties that pertain to their own localities and affairs.

The centralization of authority relating to the administration of sanitary laws may become desirable at some future time, but it would be impolitic and contrary to the well known preferences of the people and the usages of civil government in the primary areas of political or civil organization, to control

the administration of health laws so as to fail to incite and even require the inhabitants to maintain and obey local authority.

STATE BOARDS OF HEALTH.

The experience and example of the central Board of Health in each of the six States that has organized such a State Board may now serve as useful guides to the successful organization of a State Board of Health in each State that will seek to establish a general sanitary system. Each State may require to have various and essential modifications of any frame-work of a general sanitary act that might be perfectly adapted to another commonwealth. The State law on this subject in Minnesota would not be completely adapted to the necessities of certain existing statutes and necessary usages in New York, or in Massachusetts, nor would the Massachusetts law answer for Minnesota, Michigan, Virginia, and California. It will be seen, upon examination of the annexed outline of the special acts under which each of the five State Boards has respectively been established, that the friends of sanitary improvements in each State will manifestly need carefully to forecast the amount of general and intelligent coöperation which the people will put forth in the duties of sanitary administration. The law itself may and always should be an educator, but the laws and ordinances that are successful as educators must be so framed and administered as to elicit popular and exact inquiries and increase the general knowledge and appreciation of the objects for which such laws exist.

The vital importance of local sanitary authority is already exemplified in every State of the Union: and the fact must be conceded, that the faithfulness, efficiency, and permanency of good influence of the local boards of health in the rural districts, as well as in most larger towns, cannot be thoroughly secured without the central influence and certain kinds of authority of the State Board.

Thus far each one of the State Boards, has succeeded in awakening in the communities of the State an increased regard for the right and duty of every district, town, and neighborhood, to invoke the continued aids of law and instruction, to protect the interests of life and health.

A Digest and Comparison of the leading features of the special Acts by which State Boards of Health have been established in Six States of the Union.

STATE OF MASSACHUSETTS.

[By Act passed in June, 1869.]

"Seven persons shall constitute the Board of Health, and Vital Statistics," appointed by the Governor, "with advice and consent of the council," and hold office for seven years, one appointment or re-appointment being made every year.

"Sanitary investigations and inquiries in respect to the people, the causes of disease, and especially of epidemics," constitute the chief duty of the Board. It also advises the government in regard to the location of public buildings. The Secretary is the executive and only salaried member of the Board.

BOARD OF HEALTH OF LOUISIANA.

There are nine members of the Board, a majority of whom are appointed by the Governor, and minority of the Municipal Council of New Orleans. This Board has full authority over all matters relating to "Quarantine for the protection of the State." It also has charge of the Sanitary Police and Health Government of New Orleans.

The powers of this Board are inadequate to the peculiar exigencies that are associated with the nature of yellow fever epidemics. But the chief defect in sanitary powers of the State of Louisiana, is that they do not require the establishment of local Health Boards in all the Parishes of the State.

The Louisiana State Board of Health has not been commissioned or empowered to enter upon hygienic inquiries or the general duties which characterize the Massachusetts Board of Health.

STATE BOARD OF HEALTH OF CALIFORNIA.

This Board was organized in 1870. It consists of seven physicians, who hold office for four years. Their appointment is vested in the Governor alone.

The functions of this Board are defined in the same concise and general phraseology as are those of the Massachusetts Board of Health, and by the Act its members were instructed to devise and report "some scheme whereby medical and vital statistics of sanitary value may be obtained."

STATE BOARD OF HEALTH OF MINNESOTA.

This Board was organized in the Spring of 1873. It consists of seven physicians, who hold office four years, under appointment from the Governor.

The State Board is required to "place themselves in communication with local boards of health, the hospitals, asylums, and public institutions throughout the State," and "take cognizance of the interests of health and life among the citizens generally." To these duties are added all the functions which Massachusetts, Louisiana, and California have respectively assigned their State Boards of Health.

A supplementary Act has enjoined upon every town and city in the State the duty of establishing a local board of health; and the State Board is authorized to enforce this duty, and required to advise and aid the local board.

The Secretary of State, who has general charge of vital statistics, under an old law, is required to seek the counsel and aid of the State Board of Health in the Bureau of Vital Registration.

STATE BOARD OF HEALTH OF VIRGINIA.

Organized in the Spring of 1872, and consisting of seven members, all of whom must be physicians, three being residents of the city of Richmond, and four from different sections of the State, this "Board of Health and Vital Statistics" was set at work, with the strict injunction that it

"shall not in any way be a charge upon the State." Its functions are precisely like those of the State Board of California.

STATE BOARD OF HEALTH OF MICHIGAN.

This Board was organized this year. The phraseology of the Act to erect the Board, and define its functions is so well adapted to aid the deliberations of the Public Health Association, that the chief sections are here quoted. It needs to be mentioned here that other laws in Michigan provide local boards of health to establish a system of Vital Statistics: —

"SECTION 1. *The People of the State of Michigan enact*, That a board is hereby established which shall be known under the name and style of the 'State Board of Health.' It shall consist of seven members as follows: Six members who shall be appointed by the Governor with the consent of the Senate, and a secretary, as provided in section four of this act. The six members first appointed shall be so designated by the Governor that the term of office of two shall expire every two years, on the last day of January. Hereafter, the Governor, with the consent of the Senate, shall biennially appoint two members to hold their offices for six years, ending January thirty-first. Any vacancy in said board may be filled until the next regular session of the Legislature, by the Governor.

"SEC. 2. The State Board of Health shall have the general supervision of the interests of health and life of the citizens of this State. They shall especially study the vital statistics of this State, and endeavor to make intelligent and profitable use of the collected records of deaths and of sickness among the people; they shall make sanitary investigations and inquiries respecting the causes of disease, and especially of epidemics; the causes of mortality, and the effects of localities, employments, conditions, ingesta, habits, and circumstances on the health of the people. They shall, when required, or when they deem it best, advise officers of the government, or other State boards, in regard to the location, drainage, water supply, disposal of excreta, heating, and ventilation of any public institution or building. They shall from time to time recommend standard works on the subject of hygiene for the use of the schools of the State.

"SEC. 3. The board shall meet quarterly at Lansing, and at such other places and times as they may deem expedient. A majority shall be a quorum for the transaction of business. They shall choose one of their number to be their president, and may adopt rules and by-laws subject to the provisions of this act. They shall have authority to send their secretary, or a committee of the board to any part of the State, when deemed necessary to investigate the cause of any special or unusual disease or mortality.

. . . .

Sections 4 and 5 provide for the election and services of a Secretary, and specify his functions under the Board.

Sections 6 and 7 relate to expenditures.

"SEC. 8. It shall be the duty of the health physician, and also of the clerk of the local board of health in each township, city, and village in this

State, at least once in each year, to report to the State Board of Health their proceedings, and such other facts required, on blanks and in accordance with instructions received from said State Board. They shall also make special reports whenever required to do so by the State Board of Health.

"Sec. 9. In order to afford to this board better advantages for obtaining knowledge important to be incorporated with that collected through special investigations and from other sources, it shall be the duty of all officers of the State, the physicians of all mining or other incorporated companies, and the president or agent of any company chartered, organized, or transacting business under the laws of this State, so far as practicable, to furnish to the State Board of Health any information bearing upon public health which may be requested by said board for the purpose of enabling it better to perform its duties of collecting and distributing useful knowledge on this subject.

"Sec. 10. The Secretary of the State Board of Health shall be the Superintendent of Vital Statistics. Under the general direction of the Secretary of State, he shall collect these statistics, and prepare and publish the report required by law relating to births, marriages, and deaths."

Note. Since the meeting of the Association in 1873 the organization of a State Board of Health has been effected in Maryland, under a statute which confers similar powers to those exercised by most of the other State Boards. It consists of five members, — all physicians, — whose duties consist chiefly of exact sanitary inquiries and the encouraging of local sanitary organization and sanitary works.

The Legislature of New Jersey at the close of its session, 1874, provided that a Sanitary Commission should be organized for the purpose of instituting a general examination into matters affecting the public health. The Commissioners, under that law, have at once set about their duties, and hope to conduct an inquiry which will enable them to prepare a project of law for securing the organization of efficient local boards of health, and inciting general attention to the proper registration of Vital Statistics. In this Commission the State Geologist and two other citizens eminently qualified to give practical assistance in its general inquiries and duties have been judiciously united with four medical men of skill and experience.

A REPORT ON A UNIFORM SYSTEM OF REGISTRATION OF CAUSES OF DEATH THROUGHOUT THE UNITED STATES.

By CHARLES P. RUSSEL, M. D.,

Of New York.

It would appear almost superfluous to adduce any argument in support of the establishment of a uniform system of death registration throughout the United States. The advantages to be derived from such a measure are so obvious that we are struck with amazement in contemplating the chaotic condition of the field before us out of which order may be so readily evoked. For one third of a century our kinsfolk across the Atlantic have been enjoying the benefits of an admirable necrological system, while on this side there has been but little attempt at such generalization until a comparatively recent period, and even this improvement has been confined mainly to the city of New York. At the same time convocations of physicians have annually assembled from all portions of the country rather to discuss points of ethics than to investigate and carry out principles lying at the very foundation of national, medical, and sanitary science. Does it not seem therefore especially incumbent upon an association now first regularly convened for the consideration of the great and manifold questions relating to public health, to take immediate steps towards the adoption of some comprehensive, feasible, and specific plan for insuring a general statistical arrangement and common nomenclature of fatal diseases? We cannot but acknowledge that unless some such measure be accomplished our future studies of the laws which govern the diseases of our vast country will never furnish results equal to our anticipations. That a correct or even approximate estimate of the comparative prevalence of fatal affections throughout the land can be attained only by a universal adherence to one classification, none we believe will venture to gainsay. We need not dwell any longer upon so evident a proposition. It simply remains for us to submit a few considerations upon the important question: *What shall be this plan which we propose to offer to our brethren of every State for their unqualified adoption?*

The subject of nosological classification is one that for over two centuries has occupied the earnest attention of some of the most profound and ingenious minds in our profession. Since the time when Sydenham's original suggestions were practically illustrated in the "Nosologia Methodica" — that intricate and stupendous production of Boissier de Saurages, numerous other arrangements have been proposed. In this connection we shall simply allude to the labors of Linnæus at Upsala in his "Genera Morborum" — of Sagar at Iglaw, Moravia, in his "Systema Morborum Systematicum" — of

Vogel at Göttingen in his "Definitiones Generum Morborum"— and of Cullen at Edinburgh in his "Synopsis Nosologiæ Methodicæ." Among more modern contributions to this subject we may cite those of Parr, Bichat, Vicq-d'Azyr, Richerand, Young, Mason Good, and Farr. Besides the foregoing comprehensive nosological systems, many others have occurred in various ways to different minds, and have been promulgated in order to facilitate the analysis of disease. Such schemes have each an intrinsic purpose; one promotes the investigations of the pathologist — another renders more explicit the demonstrations of the clinical lecturer — both may include the whole range of morbid processes and yet be entirely dissimilar in form and expression. All such endeavors to systematize have enlarged our opportunities for acquiring knowledge in fulfilling their specific objects. But it has been found totally impracticable to frame a system of universal application from every standpoint. In the classification of diseases the extent to which their analysis shall be carried must depend upon the end in view; and for statistical purposes the individuality of certain particulars should be preserved by sufficient but not too subtile distinctions. Now it is manifest that a statistical system intended especially to exhibit prevailing conditions of salubrity as drawn from an examination of mortality tables under the ever varying circumstances of season and locality, must subject the elements within its scope to peculiar modification. Dr. Farr says: "The superiority of a classification can only be shown by the number of facts which it generalizes, or the practical results to which it leads; more arrangements of the facts than one may be useful; but the main object in view should regulate its principle; and finally a statistical nosology to throw the clearest light upon the health of a nation should be founded upon the mode in which diseases affect the population." In this respect the nosology devised by Farr himself has preëminently stood the test of experience. It does not claim to present all the existing conditions of public health with the utmost precision, as, on account of the fluctuating types of disease, figures of mortality alone do not exactly represent such conditions. They are assuredly, however, indices like weather-cocks pointing unerringly in the right direction; and they are therefore worthy of our most earnest and careful consideration.

This classification of Farr's has received the indorsement of several international statistical congresses; and it undoubtedly possesses in its practical bearings upon public health a vast superiority over any other system ever put into operation. In the language of its distinguished author it is intended to exhibit clearly and at a glance "the relative prevalence of the same classes of diseases in the greatest imaginable variety of circumstances." As all of those present may not be entirely familiar with its features, a few words of explanation may be useful.

In its first and principal group are comprised the most formidable diseases with which sanitary science has to grapple, and the investigation of which with reference to their prevention, modification, or annihilation, has within a few years become the subject perhaps of the most momentous importance to the human race in both a physical and a moral sense.

These are the epidemic, endemic, parasitic, inoculated, and epizoötic dis-

orders, as well as those resulting from the deprivation of sustenance and abuse of drink — all being classed under the general designation *Zymotic.* It is eminently proper that affections of this character should be grouped together, notwithstanding peculiarities which serve to separate them as clearly from one another as from those of a different class. The resemblance in their origin, course, influence, and effects is of vastly more consequence than the diversity in their individual traits. It has been eloquently remarked that these diseases " distinguish one country from another, one year from another ; they have formed epochs in chronology, and as Niebuhr has shown, have influenced not only the fall of cities, such as Athens and Florence, but of empires." The army of Sennacherib, while besieging Jerusalem, as narrated in Holy Writ, lost one hundred and eighty-five thousand men in a single night, under the deadly breath of the Destroying Angel — a beautiful metaphor, probably, for the swift and invisible stroke of the pestilence.

Besides the zymotic disorders there is, as Dr. Farr expresses it, " a legion of diseases never halting and not so much controlled by external circumstances, namely, sporadic diseases or ordinary maladies of every day occurrence." These prevail universally, are sometimes due to hereditary taint, sometimes apparently spontaneous or traceable to a variety of exciting causes more or less insidious, but they are not usually regarded as capable of direct propagation. However, as was noticed as far back as the Plague in Athens described by Thucydides, they not unfrequently participate in the fluctuations of epidemic diseases, being modified thereby and stamped with temporary peculiarities. The chief and most generally fatal of these are the constitutional disorders, including the tubercular and scrofulous, as phthisis, marasmus, and hydrocephalus, and the diathetic, as rheumatism and cancer. In the present English tables rheumatism is placed among the zymotic diseases, while gout figures in the constitutional. We would recommend that rheumatism be included in the latter order, as we consider it purely a diathetic disease.

Next we have the great class of local disorders — affections of special organs appropriately grouped in distinct systems ; as meningitis, apoplexy, etc., in the nervous ; aneurisms, heart diseases, etc., in the circulatory ; pneumonia, bronchitis, etc., in the respiratory ; peritonitis, gastritis, hepatitis, etc., in the digestive ; Bright's disease, cystitis, diabetes, etc., in the urinary ; necrosis, synovitis, etc., in the locomotory ; ovarian tumor, non-puerperal metritis, orchitis, etc., in the generative ; and furuncles, eczema, etc., in the integumentary.

Next come developmental diseases, or those arising from abnormal action of the formative, reproductive, or nutritive processes ; as disorders peculiar to newly-born children — premature and preternatural births, cyanosis, spina bifida, hair-lip, and other malformations ; affections resulting from advanced age, as senile gangrene and decay ; diseases consequent upon imperfect nutrition, as atrophy, asthenia, etc. ; and affections incident to the puerperal condition, or to menstrual irregularity, as puerperal peritonitis, puerperal convulsions, puerperal mania, amenorrhœa, chlorosis, etc. With

regard to the last order, we would suggest one modification. In Farr's Nosology, metria or puerperal fever is assigned a place among the zymotic diseases, while all other puerperal disorders rank in the developmental order of women. The experience of the New York Bureau of Vital Statistics proves it is impossible to maintain this distinction in classifying causes of death as returned by physicians, some designating puerperal fever as puerperal metritis, or vice versa, so that it would appear more philosophical to include all puerperal affections under the same head, namely, the developmental of women. This has been done in New York during the present year.

The final class of Farr's Nosology embraces all deaths due to violent causes, the consequences of physical or chemical forces, whether applied accidentally, suicidally, or homicidally, and as a rule comprising cases necessarily subject to judicial scrutiny. Deaths resulting from military conflict, or from execution, are likewise included in this group. Dr. Farr remarks that from a political point of view, violent deaths are of great importance, as they cut off especially the most valuable and efficient members of the community; and he therefore very properly regards them as a class to be particularly distinguished from all the rest. In large cities the statistics of such deaths form one of the most interesting and instructive studies which can be undertaken by either the professional, the political, or the moral inquirer.

We would suggest an additional order of causes to be included among those resulting from accident, namely, deaths due to surgical operations other than those found imperative after casualties, such as extirpation of tumors, urethratomy, circumcision, lithotomy, etc. In many of these instances death results directly from surgical interference; and although in others the operation may have been performed to avert either imminent or presumptive death, it seems expedient that to preserve uniformity and to obtain materials for a most valuable and hitherto neglected branch of statistics, all of such cases should be embraced in the same category.

It is to be presumed that objections to certain details of the foregoing classification will occur to some persons, but we believe that in its main features it cannot but prove acceptable to all. We do not maintain that it is absolutely perfect — but its defects become insignificant when we contemplate it as accomplishing its great purpose of throwing light upon the mysterious laws of national disease. This system has long been in vogue in Great Britain, and has been employed in the metropolis of our own country for seven years.

If our accumulations of facts are to have any value it must be not only on account of their intrinsic truth, but also from their deductions when compared with those of other countries. In this manner statistics of mortality assume vast importance, and present for our consideration manifold questions of a physical and social character. It has been well said that "science has nothing to offer more inviting in speculation than the laws of vitality, the variations of those laws in the two sexes at different ages, and the influence of civilization, occupation, locality, season, and other physical agencies,

either in generating diseases or in improving the public health." But putting aside this broad and philosophic view of the importance of mortuary statistics, it is obvious that the application of their deductions must be of immense benefit to the physician merely as a practitioner. This was perceived even as long ago as the time of Sydenham, who inculcated the doctrine that the treatment of diseases should have reference not only to the immediate symptoms and to the season, but also to the morbific constitution of the year and the locality. It has been remarked by a distinguished author that "man is not born, does not live, does not suffer, does not die in the same manner on all points of the earth. Birth, life, disease, and death, all change with the climate and soil, all are modified by race and nationality." Medicine, as well as the other natural sciences, is now abandoning vague hypothesis for truths supported by evidence, and is substituting the precision of numerical expression for the uncertainty and conjecture of theory. Only a limited number of facts, however, are contained within a single horizon. Power is derived from the aggregate observations of many inquirers in many places. But however extraordinary may be the various local circumstances thus brought into notice, they will be deprived of most of their significance unless they can all be reduced, so to speak, to a common scale. Due estimates of diseases must necessarily be impracticable unless there prevail something closely approaching an identical system of nosology in the countries between which comparisons are instituted.

In conformity, therefore, with the principles enunciated, we urge that your Association should recommend to all organizations or persons having supervision of death returns in cities, towns, or villages, of the United States, the adoption, at as early a date as may be expedient (say January 1, 1874), of Farr's Classification of Causes of Death, with the slight modifications here reported.

We would offer a few additional suggestions as to certain other essential principles in the preparation of mortuary statistics.

First as to ages. It is of course necessary that the ages of decedents by each disease should be expressed in some manner. It would, however, be a superfluous labor to attempt this for the successive years of existence, except in early childhood, when the ascertained ratios of mortality are high, and the probable duration of life vastly different within brief periods. Each year, therefore, before five years old should be enumerated, and for similar reasons every month of the first year of life should be separately expressed. After five years we know that there ensues up to a certain point a rapid decline in the death ratios during successive terms of existence, and it will consequently suffice for correct generalization to combine the ages in quinquennial periods. The difficulty in obtaining reliable data, especially from the ignorant and lower classes, so augments with increasing years, that we are forced to regard even quinquennial divisions as only a near approach to the truth. Such an approximative result, however, is much more satisfactory than the palpable inaccuracy of a yearly enumeration. All eminent authorities upon the construction of mortality tables have from the first concurred in this conclusion. The relations of these quinquennial death periods to

those of the living, given by frequent census, enable us to ascertain the general laws of national mortality — the most important object of such figures. The celebrated Swedish table was formed by Dr. Price from abstracts of the numbers of living and dying in Sweden during twenty-one years, the ages being arranged quinquennially after the fifth year of life. The Northampton, Montpelier, and Deparcieux's tables were similarly constructed.

It is necessary that the sexes should be distinguished in each period, which constitutes all the essential detail in the designation of ages.

In a population comprising so large a proportion of foreign elements as ours, the nationality of the total number of decedents by each disease should be expressed in a general way, as native or foreign, and the African race as well should be specially indicated.

The foregoing represent all the statements requisite, or indeed practicable, for a condensed exhibit of general mortality; but there are various other particulars of exceeding value in the study of individual and local affections. Such are: the condition of decedents, as married, or single, or widowed; their occupations (a most vital point), their length of residence in the locality and country; their place of birth and extraction on each parent's side; place and time of death, and duration of disease.

But by far the most important, as it is the elementary point in the formation of reliable mortuary statistics, relates to the ascertaining of the precise character, whenever known, of every cause of death. This, without reflection, would appear to be a very simple matter indeed when a diagnosis has been established, but experience proves the opposite. The attending physician may himself have a perfectly clear conception of the disease; but it is solely upon the manner in which he communicates that conception to the person who superintends the conversion of detached facts into statistical expressions that depend the proper classification and significance of the disease. Now this communication of ideas must take place by means of the document styled a *certificate of death*, wherein certain facts in regard to a deceased person are supposed to be detailed with the greatest possible brevity consistent with precision. A glance at the bills of mortality of most of our large cities will show how indifferently this is accomplished under the most favorable circumstances, a large number of causes of death being returned so ambiguously or indefinitely as to either neutralize or limit comprehension of the actual diseases, and therefore to render their figures quite useless for statistical purposes. An entire table of mortality is thus invalidated. For example, — in the report for 1872 of the Health Officer of Philadelphia, we discover nearly a thousand deaths referred simply to the following causes: casualty, congestion, concussion of brain, compression of brain, coma, cramps, disease of brain, of bones, of bladder, of liver, of lungs, of skin, of stomach, of throat, of uterus, dropsy (242 cases), effusion, hectic fever, malarial fever, nervous fever, petechial fever, fracture, gangrene, hemorrhage, suffocation, strangulation, sore mouth, shock, tumor, wounds. Such statements are devoid of any possible scientific value, and most of them defy even conjecture.

In selecting and assigning to their appropriate orders the various causes

of death, which constitute a general table of mortality, the fundamental idea of Farr's classification is to make apparent as far as possible *chief* or *primary* causes, *original* morbid processes or factors, whether they be the immediate instruments or not in producing the fatal event. For example — small-pox, measles, scarlatina, puerperal fever, appear tabulated as the only causes, although pyæmia, bronchitis, nephritis, or embolism, may have respectively supervened as determinate causes of death. For this reason the certificate should be so explicit as to leave no doubt upon such points. Obscure terms should be avoided, while merely symptomatic causes, as dropsy, convulsions (non-infantile), jaundice, etc., should always be supplemented by whatever facts may be positively known or reasonably believed as to their origin. It has been maintained by some nosologists that it is possible to eliminate entirely from a nomenclature all expressions of acknowledged indefiniteness. They would suppress the use of the. terms *Inanition*, *Marasmus*, *Convulsions*, and *Old Age.* It would, however, be impossible with our present means of diagnosis to avoid the employment of such expressions. Though vague, they yet represent ordinary conditions often of obscure origin, whose elucidation would be impracticable. They are, besides, universally employed, and their statistics are therefore useful for comparison.

It is certainly very important that physicians should designate any simultaneous or resultant affection which may complicate or follow the primary one, as statistics of special diseases are frequently most interesting and valuable on account of the different types they assume at various periods, which peculiarities are illustrated by the fluctuations of their complicating disorders. In order, also, to shed further light upon the natural history of disease, the period of duration should always be specified as regards both the original and associate cause — the vague statements, chronic and acute, being discarded. In sporadic diseases the region or organ primarily or principally involved should always be distinguished, as abscess of liver, aneurism of aorta, cancer of uterus, ulcer of stomach, etc.

Ambiguous and unintelligible terms should be particularly avoided, and for this reason a uniform designation of diseases is almost as indispensable as a common classification. It has been justly observed that the nomenclature is of as much importance in this department as weights and measures in the physical sciences, and should be settled without delay. Such terms, for instance, as nervous fever, gastric fever, congestive fever, are, without proper explanation, devoid of any special significance. In this connection we would recommend the general employment of the nomenclature adopted by the Royal College of Physicians of London, subject, of course, to such modifications and additions as the peculiar character of local or prevailing diseases may demand. We beg to conclude this report by quoting the following language of the preface to the nomenclature referred to : —

"For perfecting the statistical registration of diseases with a view to the discovery of statistical truths concerning their history, nature, and phenomena, the want of a generally recognized nomenclature of diseases has long been felt as an indispensable condition.

" The advantages accruing from accurate statistics of disease are likely to be the greater and the surer in proportion as the field of investigation is the wider.

" The statistics of a single town may be instructive; but more instruction will be obtained from the compared statistics of various and many towns. This is alike true of different districts of the same country, and of different countries and climates; and the most instructive sanitary statistics would be those which related to the whole of the inhabited portions of the globe.

" For the registration of such statistical facts it is clearly requisite that there should be a uniform nomenclature of diseases co-extensive with the area of investigation, and taking the largest area, the universal globe, the nomenclature would need to be one that can be understood and used by the educated people of all nations.

" Among the great ends of such a uniform nomenclature must be reckoned that of fixing definitely, for all places, the things about which medical observation is exercised, and of forming a steady basis upon which medical experience may be safely built.

" Another main use of the statistical registration of diseases on a wide scale is that it must tend to throw light upon the causes of disease, many of which causes, when duly recognized, may be capable of prevention, removal, or diminution.

" When a general and uniform nomenclature of disease has once been carefully framed, when we are sure that medical observation is occupying itself everywhere with the self-same diseases, the value of statistical tables becomes very high as representing the course of events in disease under various circumstances of time, place, season, climate, manners and customs, age, sex, race, and treatment.

" When fixed names have been given to diseases their classification becomes a matter of some importance. A good classification aids and simplifies the registration of diseases; helps towards a more easy comparison and knowledge of them, and towards the storing of experience respecting them; and facilitates the discovery of general principles from the collected, grouped, and compared phenomena."

THE NEED OF SANITARY ORGANIZATION IN VILLAGES AND RURAL DISTRICTS.

BY EZRA M. HUNT, M. D.,

Of New Jersey.

In considering the subject of sanitary organization in villages and rural districts, we desire to look at it from three different aspects.

I. The need of organized attention in this broad extent, if we would make the greatest progress in sanitary science.

II. The conditions of villages and rural districts as requiring for their own sake, and for that of larger cities, attention to sanitary matters in its application as an art.

III. The methods in which this need is best met.

Our first inquiry is subjective, or, in other words, it claims that the welfare of the science of Hygiene in itself considered, requires organized investigation on the broad field afforded in rural districts.

This becomes quite apparent when we consider at what sanitary science aims.

One of its first objects is definiteness of classification. Since the inductive method of study has come to be applied in medical science, it has become quite apparent that nosology is a prominent method of making advance therein. It is not merely fact we want, or observation of facts, but classified facts resulting from observation on a large scale, over a large extent, and under great varieties of circumstances.

Just as truly as in mineralogy, botany, or zoölogy, classification has to do with accuracy and extent of knowledge, just so sure is it in sanitary science that classification such as this is essential to progress. It is putting in tabulated and convenient form what we think we know, in order that it may be tested by new observation, and added to or modified by an increased number of observers. Sanitary science is to be congratulated in that to a degree not surpassed by any other department of physics, it is attempting to accumulate great series of facts, and to put its facts in form, so as to make of them not only results, but material for obtaining new results. We thus not only test what is doubtful, but find in what line of direction we are to be looking, to fill up interstices in our knowledge, or in adding new facts to those complete as far as they go, but needing expansion. We thus get extent and exactness, quantity and quality of facts, and so height, and length, and breadth, and depth, the exquisite symmetry of evidence afforded, when thus facts become knowledge so definite as to crystallize into real science. Thus Galileo made Kepler, and Kepler Newton; and

so we get at Principia, and then to third and fourth principals, etc., and go on to perfection. This is the way sanitary science is trying to work; and from being newer than some other sciences, it has some advantages, just as towns out West can be laid out and adorned easier than old Edinburgh can. Now some think all this can be done by great city statistics, just like botanists, who would do all their study in an herbarium; or zoölogists, who depend entirely upon a menagerie. These great collections are indeed great aids, and afford some advantages not enjoyed elsewhere; but after all it is needed to study things in their variety of habitudes, because locality accounts for some things; and in the very sparseness of cases, we are able to segregate what is essential and pathognomonic, from what is merely accidental or collateral.

So in disease. When aggregated, or in conditions intensely abnormal, as is so much of city life, you do not see it in its essential characteristics so clearly; and while needing to study its surroundings and the effects of these thereupon, you can often in other localities more thoroughly seek out the inherent character which the individual disease has.

A second great object of sanitary study is to find out the germs of disease. We are coming to be sure that diseases are not spontaneous generations, but are as distinct as genus and species, and are to be sought for not only as to their symptoms (the bud, foliage, flower, fruit), but as to their germ, and germinal qualities. While we cannot as yet identify the germ that causes cholera, as distinct from scarlatina, yet there are all those probabilities that attach to other sciences, that such distinctions exist, and are determinable, although, for manifold reasons, difficult to determine. So long as physicists are busy with the origin of life, we will be busy with the origin of death, *i. e.*, of disease; and we think we have the better prospect of success; for "Force and Matter," dual pets of modern scientists, show in themselves far more ability in destruction than in construction, and it is easier to trace them in disintegrating than in creating. The study of germinal origin is very complicated, and all the more so where you get it in masses, and probably even this is to be studied much from rural localities. If ever we find the producing germs of cholera, of miasmatic fevers, of influenzas, etc., it is quite probable that we are to look to some disturbances of the laws of vegetable decay, and even in epidemics originating in cities, we are often able better to study their real laws of origin by contrasting them with the modifications which occur, when the same disease is transferred to a locality, free from so many intensifying causes. Masses in disease, as in other things, sometimes make investigation inextricable; and it was easier for Jenner to trace out vaccinia in a country farm-house, than it would have been to study it among sources of complication, which always occur where various types and forms of disease crowd very thickly upon each other.

Another direction in which sanitary science is seeking enlargement is in determining the condition of the growth and development of diseases. Origin is one thing, proportion is another. We may be greatly puzzled to know how the origination of a rose occurred, but this does not necessarily embar-

rass us in studying the mode of its propagation. Hence in sanitary science the study of modes of propagation is quite distinct from that of the origin of the dynamic power of an evil germ. In this department we are studying how the germ having come somehow into existence reproduces itself, if at all, or if it invades a district, how it got there, and the somewhere from whence it came, whether in swarms as on the wings of the wind, or whether one of its kind having come, it quickly propagated itself in multitudes, and the condition under which in either case it is most favorably spread or limited. The study of all this involves very close observation, and is to be corrected by manifold experiences. One naturalist says he repeated an experiment a thousand times before he felt justified in announcing the fact as established. Now it is recognized that sanitarians in cities in order to arrive at results, must work in this line, but physicians in villages and in rural districts are not enough awake to the advantages they have in tracing diseases to their source, in studying their conditions, and in comparing them with the observation of those in cities. A great number of cases to observe is in some respects valuable, but confusion and difficulty of study sometimes arises from the too great aggregation of disease under the extra artificial condition of cities, of hospitals, etc., and very much is to be learned from a few typical cases occurring under circumstances less complicated. There is often not so much learned by observing a very great number of cases, as by exhaustive searching into a few cases, all the facts of which are more within the grasp. I once passed a little time on a plantation in Mississippi where Audubon spent weeks just watching a few birds in all their habits, and he found out more about them than if he had caged five hundred and taken them to a city infirmary. I would not press the point to extreme, or in any wise undervalue certain advantages of city sanitary study, but would desire more to impress physicians in villages and less concentrated localities with the fact that they have very much more to do, and more facilities for doing than most of them feel, and if only through the aid of these city workers we become more intelligent observers, we will be able to help much in adding to the store of facts, and in furnishing facts which both in themselves, and as materials for comparison, will enlarge the arena of sanitary science. This much we have said by way of suggestion merely as to the subjective interests of hygiene in its country aspects, since space does not permit enlargement on this point. *Next we notice the conditions of villages and rural districts as requiring for their own sake and for that of larger cities systematized attention to sanitary art.* It has come to be generally acknowledged that some system of sanitary police is demanded for all large cities. As ulcers upon the body politic, so it is recognized that the conditions physical within them are far from being normal. Sanitary science can point with pride to the practical results it has secured in these. England, on the basis of facts demonstrated in its populous towns, has lately inaugurated an extensive system of sanitary discipline, and what has been done in such cities as Boston, Providence, and New York, fully shows how practicable have been efforts in this direction in our own land. It points (by contrast) with sorrow to such places as Shreveport and Memphis as illustrating the opposite.

But there is still prevalent a lurking feeling that while oversight of this kind may be desirable for cities, there is no call for any system of the kind in villages or rural districts, and that these may be safely left to the operations of natural laws, and to such provision as the common instincts of humanity may indicate. We desire in a brief way to show how necessary it is to have a sanitary system which shall be all-embracing, and so regulated by authority as to secure efficient working throughout the land. *The first point that presents itself is that large cities and rural districts are inseparable, and frequency of association and proximity of locality necessarily expose both to similar influences.* While the cause may be more operative and virulent in the city, if it exists in the country to its degree it is there also an evil, and besides serves as a point from which contagion may be propagated. So it frequently happens that extension occurs from some rural nidus, as well as amid thickly populated cities. In these days of wonderful migration, the facilities for spreading disease are greatly multiplied, and it is difficult to say what village or railroad cluster may become a new centre for propagation. It has not unfrequently happened that variola, diphtheria, cerebro-spinal meningitis, or cholera, have in some comparatively sparse locality shown such virulence as not only to cause destruction *pro rata* to cities, but has found a centre for departure all the more severe because of the terror of the inhabitants and their recognition of the fact that no efficient methods are at hand to check the ravages. When a fire breaks out in a city there is less panic as well as real protection in the feeling that the first bell-strike starts engines for relief, but when a little country street gets on fire, or a farm-house, it burns as if conscious of unchecked independence. To some degree this is true of disease in all country districts, for although the physician is at hand to treat, he of all others most feelingly knows how utterly helpless he often is in securing the needed sanitary conditions. In the year 1866, as a member of the New Jersey State Sanitary Commission, I was ordered by telegram to proceed to a village near the Raritan River, and report as to the existence of cholera there. I was soon after waited upon by one of its physicians, informing me of the outbreak. I found on my immediate visit that when the disease had broken out and a patient or two had died of it, a physician resident in the town had sought for authority to obtain disinfectants, and to destroy the bed and clothing which had been sold at auction the day after the deaths, and before the facts were known. It was in vain that the township committee were addressed, as they said the law gave them no authority. The physician, therefore, amid the maledictions of parties concerned, set fire to the lounge and bed material which had been soiled, and a railroad company gave him an order for disinfectants. He visited all persons exposed, and treated each case of diarrhœa occurring, and we believe this prompt action on his part prevented the spread of the contagion, and yet he did it in despite of authority, and while officers were waiting for power to act, and criticising his conduct. This is but a specimen of what is constantly occurring or liable to occur in all villages and country districts. A neighbor may have a foul privy or neglected drain, or slaughter-house nuisance; a half buried dead animal may be

scenting the neighborhood, small-pox or other disease in a virulent form may have broken out in some locality, or some other source of physical evil may exist well recognized by sanitary science, both as to its character and what should be done to abate or limit it, and yet in our country and village districts, only those who have had the experience know how difficult it is to act in the premises. There is both lack of authority and greater lack of information as to the necessities of the case, and very often a nucleus of disease is fostered, and large cities have it furnished them pure and fresh from the country. As an instance Dr. Bateson, Medical Inspector of Leeds, England, traced cases of typhoid fever, breaking out in separated city localities last winter, to a country farm-house, where six persons lay sick adjoining the milk-room from which milk was furnished. A dairyman having fever in his house, supplied seventy-three families living in five different streets in Glasgow, and in these families thirty-six cases of fever occurred. We could in our own experience point to foul ponds as undoubted sources of miasm, to neglected privies at railroad stations and at private houses, which by all the rules of sanitary law have full right to reduce the standard of health; to cellars and drains that have apparently had to do with prevalent sicknesses, to mismanaged poor-houses in country districts, and to country houses, in which fever and death have been nurtured by some unsuspected nuisance. You cannot get together a number of village physicians of a few years' experience, but that each can give you positive instances in the range of his own experience, where disease has resulted from neglected sanitary police. It is not alone in the crowded city that circumstances deleterious to health are to be found. A single dwelling with a well contaminated by an ill kept drain, or its sewerage gathered in a stone heap near the house, or a privy or pond as the centre of foul excretions, or a cellar with decaying vegetables, or arrangement of furnace, or water-closet imperfect, not unfrequently leads either to a positive outbreak of disease, or to that feeling of depression which affects the general health of the family. Then when you have a row of buildings, as in a country street, with its various shops and dwellings, with no arrangement for disposal of garbage, with no restrictions upon the habits of the people, it is quite apparent, that you possess all the conditions for ill health, without the salutary influence of laws which put citizens on their guard, or abate evils where they exist. All these facts, while illustrating how even large cities are involved by intercommunication in such results as these, at the same time show how still more the immediate locality must suffer and needs the protection of law. You cannot separate city from country by any cordon, and even if you could, since vegetable organic matter exists most in the country, there are manifold diseases endemic, and to be studied there, besides the manifold type and grades of all diseases that need to be studied both in city and country. Nuisances, too, driven by sanitary law from cities, are apt to seek a local habitation in the country, and although the exposure may be less, nevertheless remain a source of evil. The only practical way is to have some discreet wide-spread sanitary power, by which both city and country can be protected

from recognized sources of disease. In such an effort there is always at first an outcry as to the restrictions of personal and private right, but sooner or later there comes that grander outcry of universal human rights, which is a higher law, namely, that no one has a right to inflict or foster an evil which endangers either his own or his neighbor's health. The real effect of such laws, when judiciously executed, is not that of an interfering espionage. Parties concerned come to know what is to their own advantage; necessary nuisances, such as slaughter-houses, etc., come to be changed into endurable abattoirs, and the people become so impressed as to the conditions of health as to be more readily able and inclined to avoid the necessities of surveillance and an abatement of evils, and a healthy process of sanitary reform goes on, not compulsory, but as a natural result of attention fastened upon the subject. Law itself is a great civilizer, a great informer, and the moment you enact a salutary law in this reading land of ours, it draws attention to the subject and leads to information, and this becomes a great educator. The conditions of healthy life become matters of public interest, and the people generally become aware that there are relations between health and modes of life, and that disease is so often a resultant of direct violations of high physical law, that it is for their interest that these laws shall be well understood and applied. It is a matter that addresses itself to the interests especially of the masses of the people, for they are the chief sufferers. Disease always makes its most deadly ravages among the working classes, who are especially exposed to the evils of crowded living, of crowded work, in ill ventilated apartments, and who can least afford the waste of time and substance which indifferent health or decided sickness involve. Many a one of these, even when not bed sick, loses his sprightliness from unrealized depressing causes, more a tax upon his energies than the demand of labor. It is easy to see how much the nation's interest is involved in all that relates to health. It is the nation's capital, that which constitutes its most intrinsic and available resource. It originates and constructs. It not merely arranges and exchanges capital, but provides it. It has so much to do with the real wealth and prosperity of a nation, that even if we should set aside the philanthropic interest which every good ruler feels, to abate as far as possible the evils of disease, from a mere economic stand-point, it is one of the clearest principles of political economy, that money is well expended in preventing or mitigating disease. We are not asking a complicated or expensive system of sanitary legislation, but we do feel that the General Government and each State should have its authorized commissioner of sanitary matters, whose business it should be to secure information as to the localities of disease, and its causes in city and country, and to spread abroad such information as is desirable, with such systematized local authority as may not only meet disease where it appears, but attend to that higher department of hygiene so often overlooked, namely, the prevention of existing causes. It is almost ludicrous were it not sadly solemn, to see how upon the outbreak of an epidemic in city or country, officers bestir themselves to stir up and remove sources of disease long existent, and which ought to have been re-

moved at other times and seasons, instead of being left to a period when their very removal for a time complicates and increases the malady. In fact it seems necessary for an epidemic now and then to appear as itself a scavenger, and as an effective method of enforcing public attention to that which is patent to a careful observer. In hygiene, indeed, we have our attention too much fastened on epidemics, and so on cities instead of upon those silent, ever operative forces of disease everywhere, and which in the aggregate kill their thousands upon thousands more than the ravages of epidemics, which startle by suddenness and largeness of numbers, but are of limited duration. If we would limit the whole aggregate of disease, we must with steady daily tread be following its path and even blaze a way ahead of it, and not merely rush forth impetuously amid its hurricanes. To do this there must be a complete wide-spread system regularly in operation. Another additional reason why it is practicable to adopt extensive and thorough systems of sanitary law extending over the land, is in the fact that science and art have reached such a degree of definiteness, as to render results certain instead of merely tentative. The illustration of this point as showing the claims of the science to be regarded as an effective art, is itself material for a paper, and is not here discussed as being covered by others.

The great practical question now comes as to the system of sanitary police to be adopted, and the method of its enforcement.

Plans as to this have been so fully before the body that I need only allude to general principles without much fullness of detail. 1st. *There must be sufficient authority.* Men of skilled judgment must be put in position and more reliance placed upon this than upon details of permit. The wisdom of such a course as this has been well illustrated in the New York Board, and although at times they have seemed to resort to high measures, results and the confidence of the people in their judgment and integrity have protected them.

2d. This authority must be within reasonable reach. In the country a mere State board is not enough, but while some competent health court should have in view the State and give advice for each part, yet there must be local organization.

3d. It must be kept as far as possible from politics and even from interference from prejudice. In some sections the trustees of school districts are the best officers, and in general if a physician is associated with them, as a Sanitary Board, it should be one chosen by the head State or National authority, for merit in this particular department. It is not safe to assume that a physician doing a good practice is a good sanitarian. We believe it should be so far connected with the Regular Army, as that the chief National officers should be from it, and State officers be chosen from a special corps, resident in each State, who, by examination or otherwise, have been recognized as adapted for the special duty, and not liable to be ordered from the State. The pay of these need not be large unless the duties prove onerous. The amount to be expended need only keep pace with the progress of the science and of public opinion in respect to it, and at first

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much good might be done by the distribution of health tracts through the medium of District Assessors. We prefer the Regular Army because of its well organized adaptability, because its attention is naturally directed to sanitary police, and it is kept from the party influence of office seekers to be found among sanitarians as elsewhere, and because of its good facilities for the collection of facts and material. Great simplicity of organization is to be carefully studied, and what is done needs to be well applied. We name school trustees as proper local officers, because in the country it is the duty, each year, of one of them to visit each house and enroll the children, and township assessors can also be used because they have to make house to house visitations. In my own State these last collect vital statistics, but from want of direction fail in thoroughness. We believe, that with proper instructions from some central authority, accuracy could be secured, and information spread among the people. In small cities the same might devolve upon Boards of Education, while Boards of Health, as at present conducted, avail in larger cities. Where school officers act, the incidental effect will also be to draw their attention to the matter, and our schools, both as to their management and instruction, would have hygiene more prominent, and so the young would grow up better informed as to the conditions of health.

If sanitarians will only continue to show how definite this department is as a science, how successful it is proving itself as an applied art, and how much more it can accomplish if law will but extend its ægis, and if our profession will only urge codes suited to varied conditions of locality and population, in city and country, we shall not fail of success. If we but keep the zeal of philanthropy more prominent than fame or aggrandizement, we shall receive civic as well as professional aid. So shall we secure great harvests of advantage for the welfare of all peoples; those aiding and abetting us shall be counted benefactors, and grateful communities and nations will, in fullness of time, send their wreaths to adorn the temples at whose shrines sanitarians serve as true ministers of humanity.

BOARDS OF HEALTH IN THE UNITED STATES.

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Preventive Medicine as a distinct branch of the profession is, as yet, in its infancy, and is just beginning to attract the attention of the educated physician, which its great importance to the welfare of populous communities demands. Partaking in this feeling, and as an humble investigator, ever anxious to accumulate evidence and add new facts that may tend to popularize and advance public hygiene, we have prepared this paper. State medicine is systematic, rational, self-protective. It proposes and makes use of an organized medical police, and should be preventive and reformative. In the law of nature itself, it finds its warrant for the exercise of this right. Disease is not only a calamity to the individual, but a positive loss to the State. Individuals constitute communities, and healthy communities must prosper, just as sickly ones will, of necessity, bear an inverse ratio to them in everything that pertains to prosperity. Can any rational man doubt that the government fails to perform its duty when it permits the existence of a preventable disease?

We know how grudgingly legislatures invest Boards of Health with sufficient power to properly perform their important trusts, not only to define nuisances, but to confer the authority to summarily suppress them. The courts, too, have been chary in their construction of any such law as would recognize anything a nuisance that is not plainly and notoriously destructive of health, lest they should seem to abridge the rights of property and individual freedom. Not only danger to, but the actual sacrifice of life is demanded by the court as the reason upon which to base an order for suppressing a nuisance. Thousands of dollars are lavishly granted for the apprehension of some monster violator against the laws of property, a thief, an incendiary, or perhaps, a murderer, while fifty or a hundred would be refused for the removal of some offensive factory or business, a nuisance that is degrading to all the finer senses, as well as detrimental to the health of a neighborhood — that is slowly destroying scores of valuable lives. The Protean conditions that cause disease are not necessarily all present at one time, physical and palpable; nor are these factors alone of earth or of air; many of them originate out of man's pursuits, and his gregarious and vicious habits. The senses are the sentinels that keep watch to protect man from physical pain and moral shock. If all or any of the senses are degraded, and familiarized with moral or physical filth — by sight, sound, smell, taste, or feeling — the individual is no longer a responsible person. Therefore, it follows that nuisances, dangerous to society and destructive to health, may

exist in any domain of the social organization. They are lurking in any usage or condition of man or his surroundings which shock and degrade his neighbor's finer sensibilities. It is a much slower and more difficult task to educate a community to appreciate these higher sensibilities, the outgrowth alone of culture and civilization, than it is to impart a knowledge of letters. Modern society is on the verge of recognizing the wisdom of compelling all persons to be schooled. We may, therefore, hope something from the future in guarding man's surroundings. The sense of sight and sound has as good a right to claim protection as that of smell. As the government employs experts to ferret out crime, and selects those skilled in the law to examine into its violations, and fix the punishment of its infraction, why should it not engage those competent to detect and point out the conditions in a country that are perpetuating ignorance, violating hygienic laws, lowering the standard of moral sensibilities, checking prosperity, producing and entailing disease with poverty, crime, and a high death-rate. All these deserve to be studied, and reform commenced. Civilization, religion itself, of whatever form, is the result of education.

The habits of society of the present age — conducting an immense commerce — and creating great cities and markets for exchanging the products of the world, with showy palaces which of necessity entail the counterparts of poverty, crowding, and consequent degraded habits of the serfs to mammon. The sick, the cripple, the demented, and, in a word, all who cannot provide for themselves must be taken care of by the community; but we must not let this class either exhaust our charity or cause us to be forgetful of our duty to care for a still more deserving and useful class. The young, and those whose health and morals are not yet degraded, and whose usefulness in the world may be assured by the watchful care of sanitary police, these most urgently demand our sympathy and protection.

If these views of the sphere and province of State medicine be correct, it is evident that the duties of the sanitary physician are constantly widening, and in places they will interlace with those of the moralist and priest. To the end that we might have the data for a just appreciation of the actual sanitary condition of the towns and cities of our country, we prepared in 1873 a circular of inquiry which was sent out at our request by the Commissioner of Education, to the Board of Health, or other Health Officers, in every city and town in the United States of over five thousand population. Responses in a majority of cases were received, some cities with large populations confessing that they had no Board of Health. Unfortunate Memphis, with a population of fifty thousand, was among this class. Her recent suffering has taught her a severe lesson. The accompanying tables present in brief all the important facts elicited. The circulars were perhaps not as comprehensive and explicit in the inquiries as a more practical hygienist might have drawn up. One of the first purposes was to know definitely what towns and cities had Boards of Health, of a character able to point out the causes which are deteriorating health, and also to give warning of danger on the approach of an epidemic.

The table is satisfactory on this point. Other inquiries were made for the

purpose of ascertaining the extent of territory within the corporate limits; the actual population within such limits; whether the streets and sidewalks of the town were paved or macadamized; whether the water used in the place was obtained from pumps, cisterns, or wells, or whether it was supplied from a larger stream and then distributed; whether the town or city had underground sewerage or only surface drainage, and how complete and satisfactory these were. Generally these inquiries were answered in a satisfactory manner. To the inquiries as to the character of the ventilation of the public buildings, school-houses, churches, etc., very indifferent replies were received. The fact is apparent from the replies that the majority of persons who have not made sanitary matters a study, believe that all large buildings are of necessity, or by virtue of their size, well ventilated and supplied with abundance of fresh air; so that answers to this question must be taken with a qualification.

Respecting each Board of Health we asked the number comprising it, by whom and for what period appointed, their compensation, the duties of the Board, whether they were required to register births, deaths, and marriages, their powers to define and remove nuisances, or only define, etc., the authority to publish reports, etc.

These inquiries were either not well understood or there was much indifference in answering them, so that they are less satisfactory for want of completeness than is desirable for the student in his efforts at generalization. The inquiry as to the highest and lowest point above sea level within the corporate limits, was made to turn attention to the importance of altitude on health, and to enable the reader to form an approximate judgment as to the capability of the place for a complete system of draining or sewerage. If there is any one part of practical sanitary science less understood and more backward than another, it is that of the engineering branch of city improvements. The necessity for sewerage and drainage is always self-evident, and it is often a simple and light thing for a Board of Health, or of Public Works, to authorize a sewer, but the proper size to be laid in a particular street, at what depth and the best form and pitch to such sewers that it will connect all lateral sewers so that they may relieve each other in floods throughout a large city of irregular ground surfaces, demands the ability and patient investigation of a first-class engineer. In my humble opinion no Board of Health can be considered complete that has not in it or for referee a competent sanitary engineer. A complete system of drainage and sewerage secures for a city great advantages, and lightens the other labors of the sanitarian. The writer does not aim to present a report, but rather to put on record the condition of the cities of the United States, as regards health organizations, collected by means of the circulars referred to. The tables are printed with all their imperfections and short-comings, hoping to encourage more fruitful efforts in this direction by others.

Statistics of Boards of Health in the United States, for 1872–73.

CITY AND STATE.	Name of Board.	No. Members of Board.	Bounds within which its Authority is exercised.	Population — Actual or Estimated.	When organized?	By whom is the Board selected?	What Amount of Salary to Members?	Does the Board derive its Power from State or City?
Mobile..........Ala.	Board of Health.......	5	City.......................	41,385	1843	Medical Society of Mobile.........	Secretary, $500 per annum.........	Both.......
Selma..........Ala.	Board of Health.......	5	City.......................	10,000	1871	Selma Medical Society.............		Both.......
Tuscaloosa......Ala.				3,000	....			
California...........	State Board of Health.	7	State......................	560,247	1870	Appointed by Governor............	Permanent Secretary, $2.500.......	State........
Oakland........Cal.	Board of Health.......	3	City limits................	16,000	1868	City Council......................		City........
Sacramento.....Cal.	Board of Health.......				....	Municipal authorities..............		
San Francisco...Cal.	Board of Health.......	5	City and County...........	180,000	1870	Appointed by Governor............		State........
Stockton........Cal.	Board of Health.......				....	Municipal authorities..............		
Bridgeport....Conn.	Board of Health.......	7	City.......................	24,000	1869	People............................		State........
Hartford......Conn.	Health Committee.....	10	City.......................	40,000	....	City Government..................	Assistant Chairman, $400..........	
New Haven...Conn.	Board of Health.......	7	City.......................	55,000	1872	Nom. by Mayor, app. by Aldermen.	Health Officer and Secretary, $1,000	State........
Stonington....Conn.	Health Committee.....	3	Borough limits...........	2,000	1801	Warden and Burgesses............		State........
Wilmington.....Del.	Board of Health.......	21	One mile beyond city.......	38,000	1833	City Council......................	$1.80 each, per meeting...........	City........
Washington....D. C.	Board of Health.......	5	Entire district............	140,000	1871	President of United States.........	$2,000 each, annually.............	Gen. Gov't & Dist. Legisla.
Pensacola.......Fla.	Board of City Council.	8	City and Harbor...........	4,000	1822	Citizens..........................		State........
Columbia........Ga.	Board of Health.......	6	Corporate limits of City....	8,000	1833	Mayor and Aldermen.............		City........
Savannah.......Ga.	Board of Health.......	64	Taxable limits of City.....	29,000	1868	Mayor, Ex-officers, & Chief of Police	Regular pay and salaries...........	City........
Amboy..........Ill.		4	One mile square...........	3,000	....	Mayor............................		City........
Bushnell.........Ill.	Board of Health.......	5	Five miles................	3,500	1869	City Council......................	Fixed by ordinance...............	City........
Canton..........Ill.		3	City limits................	4,000	1849	City Council......................		City........
Chicago.........Ill.	Board of Health.......	7	Four miles beyond City....	400,000	1867	Judges of Superior Court and Mayor		State........
Decatur.........Ill.	Board of Health.......	7	Half mile beyond City limits	10,000	1857	Mayor............................		City........
Galena..........Ill.	Board of Health.......	1	City limits................	7–8,000	1825	City Council......................	Marshal, $5,000..................	City........
Joliet...........Ill.	Board of Health.......	6	Six wards of City..........	10,000	1872	Mayor and Common Council.......		City........
Monmouth.......Ill.	Board of Health.......	3	Two miles square..........	6,000	1865	Mayor and Common Council.......	$2 each meeting..................	City........
Peoria...........Ill.	Board of Health.......	4	City and five miles out.....	28,000	1850	Mayor and Common Council.......		Both.......
Rockford........Ill.	Health Officer.........	Indef.	City limits................	12,000	1854	Common Council..................		City........
Shelbyville.....Ill.	Board of Health.......	3	City limits................	3,000	1870	City Council......................	President, salary; Physicians, a fee.	City........
Evansville......Ind.	Board of Health.......	6	City.......................	35,000	1872	City Council......................		City........
Fort Wayne.....Ind.		3	City.......................	30,000	1844	Council..........................	$75 each..........................	City........

Statistics of Boards of Health in the United States for 1872–73.—(Continued.)

City and State.	What Proportion of the Board are Physicians?	Is the Chief Health Officer selected by or from the Board, or is he appointed?	How often does the Board meet?	Are the Powers of the Board specifically defined or limited by Law?	Has Board a Corps of Assistant Health Officers?	Are they all Physicians?	How many Assistants?	Have they Police Powers?	Has the Board Authority to abate, or only to define Nuisances?	Has Board Authority Independent of City Councils and Police?	Has the Board Power to remove Persons sick with Contagious Diseases to Special Hospital?
Mobile.........Ala.	All...	By the Board.......	Weekly	No	No			Yes	Abate	No	Indefinite.
Selma.........Ala.	All...	By and from the Board	Every two weeks	No	No				Define	No	Yes.
Tuscaloosa......Ala.									City authority		
California	All...	Elected by Board	Quarterly	Yes	No				No	No	No.
Oakland.........Cal.	All...	Appointed	Monthly	Yes	No			No	Abate	Yes	Yes.
Sacramento......Cal.										No	Yes.
San Francisco...Cal.	4-5ths.	Elected by Board	On call	Yes	Yes	Yes		No	Both	Yes	Yes.
Stockton........Cal.										No	Yes.
Bridgeport....Conn.			On call of Mayor	Yes	No				Abate	Yes	No.
Hartford......Conn.	Half..	By City Council	Very seldom		Yes	Yes	One	No	Abate	Yes	No.
New Haven...Conn.	Three.	Selected	Monthly, weekly, and oftener.	Yes	Yes		May have 3		Abate	Yes	Yes.
Stonington....Conn.	One...		No regular meetings	By Stat. law	Yes				Abate	Yes	Yes.
Wilmington.....Del.	One...	Appointed by Governor	Monthly	General	No				Both	Yes	Yes.
Washington....D. C.	3-5ths.	From the Board	Semi-weekly	Yes	No			No	Both	Yes	Yes.
Pensacola.......Fla.	None.	Appointed by Board	Semi-monthly	Yes	No			Yes	Abate		Yes.
Columbia........Ga.	All...	Selected from Board	Monthly	Yes	No	Yes		Yes	Both	Yes	Yes.
Savannah........Ga.	None.	Elected by City Council	At will	City Ord'nce	No		None	Yes	Both	No	Yes.
Amboy..........Ill.	One...	Appointed	Monthly	No	No		None		Define		Yes.
Bushnell........Ill.	One...	Appointed	Monthly	Yes	No	Pres. & Clk. exc.	None	Board has	Both	Yes	Yes.
Canton..........Ill.	One..	Appointed	Every ten weeks						Abate	Yes	Yes.
Chicago.........Ill.	Three.	Selected by Board	Weekly	No	Yes	Four	24	Yes	Both	Yes	Yes.
Decatur.........Ill.	Two..	Mayor is Chief by Ordinance	When necessary		No				Both	No	Yes.
Galena..........Ill.		Appointed by City	On duty all the time	Yes	In emergency	Yes	Five	Yes	Both	Yes	Yes.
Joliet..........Ill.	One..	Appointed by City	Weekly in Summer	Yes	Yes	One	Six	Yes	Both	Yes	Yes.
Monmouth.......Ill.	One..	Appointed by City	When required	Lim. by Ord.	No	One			Both	No	Yes.
Peoria..........Ill.		Appointed by Mayor	Semi-monthly	Yes	No				Both	Yes	Yes.
Rockford........Ill.		Appointed	No regular time	Yes	No			B'rd has	Both	Yes	Yes.
Shelbyville......Ill.	2-3ds.	Appointed	No regular time	Yes	No				Abate	Yes	Yes.
Evansville......Ind.	5-6ths.	Appointed by Council	Monthly or oftener	Yes	No	One	Police		Abate	No	Yes, if necessary.
Fort Wayne.....Ind.	All...	Appointed by Board	Monthly	Yes	No	Yes			Abate	Yes	Yes.

Statistics of Boards of Health in the United States for 1872–73.—(Continued.)

City and State.	Name of Board.	No. Members of Board.	Bounds within which its Authority is exercised.	Population — Actual or Estimated.	When organized?	By whom is the Board selected?	What Amount of Salary to Members?	Does the Board derive its Power from State or City?
Goshen . . . Ind.	. . .	4	City limits	4,000	1870	City Council	. . .	City
Indianapolis . . . Ind.	Board of Health	3	Two miles beyond City	60,000	1872	City Council	President, $200; Secretary, $400	City
Laporte . . . Ind.	. . .	3	Two miles beyond City	10,000	. . . .	City Council	$100 per annum, divided among three	City
Logansport . . . Ind.	. . .	3	One mile beyond City	12,000	1850	City Council	$25	Both
Peru . . . Ind.	Board of Health	3	City limits	6,000	1867	City Council	. . .	City
Richmond . . . Ind.	. . .	. . . . . .	Two miles beyond City	15,000	1858	City Council	$50 each	Both
Clinton . . . Iowa	Common Council	9	Corporate limits	8,000	1857	By the People	. . .	City
Council Bluffs . . Iowa	Board of Health	3	City limits	10,000	1869	Mayor	. . .	City
Fort Madison . . Iowa	Board of Health	3	City	5,200	1850	City Council	. . .	City
Independence . . Iowa	. . .	1	City	3,500	1866	City Council	. . .	City
Marshall . . . Iowa	Board of Health	9	City	5,000	1871	Election	$1 each, per meeting	State
Fort Scott . . . Kansas	Board of Health	5	City, five miles circle	10,000	1871	Mayor	M. D. of Board for actual service	Both
Leavenworth . Kansas	. . .	5	City	5,000	1855	Mayor and Council	. . .	City
Ottawa . . . Kansas	. . .	9	Five miles out of City	5,000	1868	The People	. . .	State
Paola . . . Kansas	Board of Health	City Coun.	Five miles Corporate limits	5,000	1869	. . .	. . .	State
Topeka . . . Kansas	. . .	3	City	12,000	. . . .	Mayor	. . .	City
Louisville . . . Ky.	Board of Health	9	City limits	125,000	1870	General Council	Mayor, C. Police, C. Engin. 2 Phy.	City
New Orleans . . . La.	State Board of Health.	9	City, and Quar'tine Stations	200,000	1855	Governor and City Council	Pres. and Sec. rec. $2,000 pr. an. each	State
Augusta . . . Me.	Health Committee	3	City	9,000	. . . .	City Council	. . .	State
Bangor . . . Me.	. . .	. . . . . .	Six by seven miles	20,000	1834	City Council	Health Officer, salary last year $5.00	Both
Biddeford . . . Me.	Board of Health	3	Dist. Four of City	11,000	1857	Mayor and City Council	$30 each, per annum	City
Belfast . . . Me.	Board of Health	3	City limits	6,000	1853	City Government	. . .	City
Portland . . . Me.	Board of Health	3	City limits	33,000	1833	Mayor	. . .	State
Baltimore . . . Md.	. . .	2	Corporate limits City	350,000	1798	Mayor	Com. $2,500; Assist. Com. $1,500	City
Massachusetts . . .	State Board of Health.	7	State	. . . .	1869	Governor	Secretary, $2,500	State
Boston . . . Mass.	Board of Health	3	City limits	300,000	1873	Mayor, and confirmed by Council	Each, $4,000 per annum	Both
Cambridge . . . Mass.	Board of Health	11	City	45,000	1846	City Council, by Ordinance	. . .	State
Chelsea . . . Mass.	. . .	9	City limits	20,000	1857	By the People	Mayor, $400 per annum	State
Fall River . . . Mass.	. . .	7	City	37,000	1854	By the People	. . .	Both
Haverhill . . . Mass.	Board of Health	3	Three by nine miles	15,000	1870	City Council	. . .	Statutes
Lawrence . . . Mass.	Board of Health	7	City	30,000	. . . .	Popular Election	Mayor, for general office, $1,500	Both

Statistics of Boards of Health in the United States for 1872–73.—(Continued.)

City and State.	What Proportion of the Board are Physicians?	Is the Chief Health Officer selected by or from Board, or is he appointed?	How often does the Board meet?	Are the Powers of the Board specifically defined or limited by Law?	Has Board a Corps of Assistant Health Officers?	Are they all Physicians?	How many Assistants?	Have they Police Powers?	Has the Board Authority to abate, or only to define Nuisances?	Has Board Authority independent of City Councils and Police?	Has the Board Power to remove Persons sick with Contagious Diseases to Special Hospital?
Goshen ... Ind.	Allbut one	By Board	Quarterly, on call of Mayor		No.	Yes			Define.	Yes	Yes.
Indianapolis ... Ind.	All	By Board	Monthly	Yes	No.	Yes			Abate	Yes	Yes.
Laporte ... Ind.	All	By Board	No stated period	Yes	No.	Yes			Abate	Yes	Yes.
Logansport ... Ind.	All	By Board	Monthly	Yes	No.	Yes			Abate	Yes	Yes.
Peru ... Ind.	All	By Board	At call of President	Yes	No.				Both	No.	Yes.
Richmond ... Ind.	One	By Board	On call	Yes	No.				Abate	No.	Yes.
Clinton ... Iowa	None	Mayor is Health Officer	Monthly	Yes	No.			Yes	Both	No.	Yes.
Council Bluffs .. Iowa		Appointed	When necessary	Yes	No.				Abate	No.	Yes.
Fort Madison .. Iowa	Two	No Chief	Only as required	No.	No.				Abate		Yes.
Independence .. Iowa	All	Appointed by City Council		No.	No.				Both	Yes	Yes.
Marshall ... Iowa	Two	Appointed by City Council	Monthly	No.	Yes	Two	Five	Yes	Abate	No.	Yes.
Fort Scott ... Kansas	One		Often as Mayor thinks neces'y	Yes	No.	No.	Seven	No.	Both	Yes	Yes.
Leavenworth. Kansas	One	From Board	Monthly	Yes	No.	No.		Partial.	Define.	Yes	Yes.
Ottawa ... Kansas		Mayor	Semi-monthly						Both	No.	Yes.
Paola ... Kansas				Yes	No.				Unlim'd	Yes	Yes.
Topeka ... Kansas			When necessity requires	Partly					Abate	No.	Yes.
Louisville ... Ky.	2-3ds.	By General Council	No regular time	Excessively limited	Four	Yes			Define.	No.	No.
New Orleans ... La.	Maj'ty		Monthly, Winter; w'kly, Sum.	Yes	Four	Yes	Twelve.		Both	Yes	Yes.
Augusta ... Me.	1-3d.		When specially called	Yes	No.				Both	Yes	Yes.
Bangor ... Me.				Yes	No.				Both	Yes	Yes.
Biddeford ... Me.	None	Appointed	When necessary	Yes	No.			Yes	Abate	No.	Yes.
Belfast ... Me.	1-3d.	Appointed	When necessary	No.					Both	Yes	Yes.
Portland ... Me.				Yes				Yes	Abate		Yes.
Baltimore ... Md.	One	Appointed	Daily	By City Ord.	Yes	Ten	Four	Yes	Abate	No.	Not without consent.
Massachusetts ...	3 of 7		Every three months, oftener if necessary.	Yes					On complaint	Yes	No.
Boston ... Mass.	One		Daily	Yes	No.			Yes	Abate	Yes	Yes.
Cambridge ... Mass.		Appointed by Board	Weekly	Law & Ord.	Yes	No.	Three	Yes	Abate		Yes.
Chelsea ... Mass.	None	Appointed by Board	Weekly	Yes	Yes	One			Abate	No.	Yes.
Fall River ... Mass.		Appointed	Semi-monthly	Yes	No.				Both	Yes	Yes.
Haverhill ... Mass.			At own option	No.	No.				Both	Yes	Yes.
Lawrence ... Mass.		By Board		Yes						Yes	Under State laws.

Statistics of Boards of Health in the United States for 1872–73. — (*Continued.*)

City and State.	Name of Board.	No. Members of Board.	Bounds within which its Authority is exercised.	Population — Actual or Estimated.	When organized?	By whom is the Board selected?	What Amount of Salary to Members?	Does the Board derive its Power from State or City?
Lowell, Mass.	Board of Health	5	City	45,000	....	City Council	....	Both
Lynn, Mass.	....	9	City	30,000	1850	City Council	....	Both
Springfield, Mass.	Board of Health	9	City	28,000	1852	The People	Mayor, $1,600, ex-officio member	Both
Worcester, Mass.	Board of Health	9	City	50,000	1848	The People	....	Both
Michigan	State Board of Health.	......	....	....	....	....	....	....
Ann Arbor, Mich.	Board of Health	3	Within City	9,000	....	Common Council	....	State
Battle Creek, Mich.	Sanitary Committee	4	City	6,000	1859	The Mayor	....	City
Bay City, Mich.	Board of Health	2	City limits	12,000	1872	The Mayor	$300 per annum, each	City
Detroit, Mich.	Board of Health	15	City limits	100,000	....	Eleven, election; four, appointed	Each $1.50 per session for services	Both
Grand Haven, Mich.	Board of Health	10	City limits	7,000	1872	Board consists of Common Council.	....	....
Grand Rapids, Mich.	Board of Health	3	City limits	20,000	1871	Common Council	$100 per annum, $3 per day when on duty.	Both
Marshall, Mich.	Board of Health	3	City limits	7,000	1859	Mayor	....	City
Monroe, Mich.	Board of Health	5	City limits	6,000	1834	Mayor	....	City
Saginaw, Mich.	Board of Health	5	City limits	8,000	1860	Common Council	....	City
Ypsilante, Mich.	Board of Health	6	City	5,600	1858	Common Council	....	City
Minnesota	State Board of Health.	......	....	....	....	....	....	....
Duluth, Minn.	Board of Health	4	City	5,000	1873	....	Health Officer, $300	City
Minneapolis, Minn.	Board of Health	6	City	25,000	1868	....	Health Officer, $200	State
Vicksburg, Miss.	Board of Health	3	....	15,000	1872	Mayor and Aldermen	One officer, $1,200	City
Hannibal, Mo.	Board of Health	4	Five miles beyond City	15,000	....	Mayor	City Physician, $500	City
Macon, Mo.	Board of Health	3	City limits	5,000	1866	City Council	....	City
St. Joseph, Mo.	Board of Health	7	City limits	30,000	1864	Mayor and City Council	$2 each, for meeting	City
St. Louis, Mo.	Board of Health	5	....	400,000	1870	Mayor and City Council	Four members, $500 each	State & City
Omaha, Neb.	Board of Health	3	City limits	18,000	....	The People	....	City
Concord, N. H.	Health Officers of City	3	City limits	15,000	1853	Mayor and Aldermen	....	State & City
Nashua, N. H.	Board of Health	3	City limits	11,500	1853	Mayor and Aldermen	$25 each	State & City
Jersey City, N. J.	Health Department	10	City limits	100,000	1871	Board of Police Commissioners	Health Inspectors, City Physicians.	....
Millville, N. J.	Board of Health	4	City limits	7,000	1871	Common Council	....	City
Newark, N. J.	Board of Health	5	City	115,000	1858	....	....	City
Orange, N. J.	Board of Health	5	City	9,343	1866	People, Mayor, and Council	Physicians, $150	State
Paterson, N. J.	Department of Health.	5	City	36,000	1871	Board of Aldermen	....	Both
Auburn, N. Y.	Board of Health	5	City	25,000	1848	Common Council	....	State
Brooklyn, N. Y.	Board of Health	8	City limits	450,000	1870	President, and Board of Aldermen	....	City

Statistics of Boards of Health in the United States for 1872–73.—(*Continued.*)

City and State.	What Proportion of the Board are Physicians?	Is the Chief Health Officer selected by or from the Board, or is he appointed?	How often does the Board meet?	Are the Powers of the Board specifically defined or limited by Law?	Has Board a Corps of Assistant Health Officers?	Are they all Physicians?	How many Assistants?	Have they Police Powers?	Has the Board Authority to abate, or only to define Nuisances?	Has Board Authority independent of City Councils and Police?	Has the Board Power to remove Persons sick with Contagious Diseases to special Hospital?
Lowell........Mass.	1-4th.	By City Council	When required	Yes	Yes	Yes	Six.		Abate	Yes	Yes.
Lynn..........Mass.		Appointed	When required	Yes		One	Two		Both	Yes	Yes.
Springfield.....Mass.		City Council, annually	When required	Yes	No.				Abate	Yes	Yes.
Worcester.....Mass.			When called by Chairman	Not wholly.	No.				Abate	Yes	Yes.
Michigan											
Ann Arbor....Mich.	One	By Board	No stated periods	Yes	No.				Abate	Yes	Yes.
Battle Creek...Mich.	None	The People	Weekly	Yes	No.				Both	Yes	Yes.
Bay City......Mich.	One	Appointed		Yes	No.			No.	Abate	Yes	Yes.
Detroit........Mich.	Four		No regular time	By Ord'nce	No.			No.	Both	No.	Yes.
Grand Haven..Mich.	One	Mayor is Chairman	When necessary	No.	No.				Abate	Yes	Yes.
Grand Rapids.Mich.	One	By Common Council	When necessary	No.	No.				Abate	No.	Yes.
Marshall......Mich.	None	Appointed by Council		Yes	No.			Yes	Abate	No.	Yes.
Monroe.......Mich.	One	Appointed	Once in two weeks	Yes	No.			Yes	Both	No.	Yes.
Saginaw.......Mich.	One	Appointed by Council	Monthly	Yes	No.				Both	Yes	Yes.
Ypsilanti......Mich.	One	Appointed by Council	When necessary	Yes	No.				Both	Yes	Yes.
Minnesota											
Duluth........Minn.	One	Appointed by Council	Monthly	Yes	No.				Abate	Yes	Yes.
Minneapolis...Minn.	One	Appointed by Council	Monthly	No.	No.				Both	No.	Yes.
Vicksburg......Miss.	All	Appointed	Semi-monthly	No.	Yes	No.	One	Yes	Both	Yes	Yes.
Hannibal.......Mo.	1-4th.	Appointed by Council	On call of Chairman	Yes	No.				Both	No.	Only Charity Cases.
Macon..........Mo.	None	Appointed	Monthly	Yes	Yes	One	Two	B'd has	Abate	No.	Yes.
St. Joseph.....Mo.	One	Appointed by Council	Monthly	Yes	No.				Abate	Yes	Yes.
St. Louis........Mo.	Two	Appointed by Board	Weekly or semi-weekly	Yes	No.		Two	Yes	Both	No.	Yes, by request.
Omaha........Neb.	None	Have none	As occasion requires	No.	No.	No.		Yes	Abate	No.	Yes.
Concord......N. H.	1-5th.	Appointed	When a case is reported	Yes	No.				Define.	No.	Yes.
Nashua.......N. H.	One	City Marshal is Chairman	When necessary	Yes	No.				Both	Yes	Yes.
Jersey City....N. J.	3-5ths.		Monthly	Yes	Yes	Yes		Yes	Abate	Yes	Yes.
Millville.......N. J.	None	By the Board	As occasion requires	No.	No.	No.		Yes	Abate	Yes	Yes.
Newark........N. J.	One	App'ted by Common Council.	Twenty times a year	Yes	Yes	Yes	Eight	Yes	Abate	Yes	Yes.
Orange........N. J.	1-4th.	Appointed by Council	When necessary	Yes					Abate	No.	Yes.
Paterson.......N. J.	None	Appointed by B'd Aldermen.	Monthly or oftener	Yes	No.					No.	Yes.
Auburn.......N. Y.	One	From the Board	Monthly	Yes	No.				Both	Yes	Yes.
Brooklyn......N. Y.	None	Appointed by Board	On call	Yes	Yes	Yes	One	Yes	Both	Yes	Yes.

Statistics of Boards of Health in the United States for 1872–73.—(Continued.)

City and State.	Name of Board.	No. Members of Board.	Bounds within which its Authority is exercised.	Population—Actual or Estimated.	When organized?	By whom is the Board selected?	What Amount of Salary to Members?	Does the Board derive its Power from State or City.
Buffalo........N. Y.	Board of Health.......	3	City......................	150,000	1870	Elected by the People	....	State ....
Cohoes........N. Y.	Board of Health.......	5	Corporate limits...........	20,000	1870	Common Council..................	Health Officer, $550..............	Both ....
Elmira........N. Y.	Board of Health.......	7	City......................	20,000	1840	Common Council..................	Each, $50.........................	State ....
Hudson.......N. Y.	Board of Health.......	5	City limits	10,000	....	Mayor............................	....	City........
Newburgh.....N. Y.	Board of Health.......	4	City limits	17,400	1865	Common Council..................	....	Both ....
New York.....N. Y.	Board of Health of Health Department.	4 (2 ex-officio)	City......................	1,000,000	1866	Mayor..........................	President, $6,500; 1 member, $5,000	State ....
Poughkeepsie..N. Y.	Board of Health.......	7	City limits	21,000	1850	Common Council..................	Secretary	State ....
Rochester.....N. Y.	Board of Health.......	7	City......................	70,000	....	Common Council..................	....	Both ....
Troy..........N. Y.	Board of Health.......	6	City limits	50,000	1850	People..........................	Health Officer, $1,000	Both ....
Fayetteville....N. C.	Sanitary Committee ...	15	Limits of town	5,000	1800	Mayor and Commissioners	....	Town.......
Cleveland ......Ohio	Board of Health.......	7	City limits	115,000	1859	Mayor and City Council	....	State ....
Dayton.........Ohio	Board of Health.......	6	Corporate limits...........	30,000	1867	City Council	....	Both ....
Hamilton ......Ohio	Board of Health.......	8	City limits	15,000	1865	City Council	Health Officer, $300; Clerk, $250 ..	State ....
Ironton ....Ohio	Board of Health.......	6	Corporation...............	9,000	1863	City Council	....	City........
Mt. Vernon.....Ohio	Board of Health.......	7	City limits	6,000	1854	Mayor and City Council...........	....	Both ....
Portsmouth.....Ohio	Board of Health.......	7	City and Wayne township..	3,000	1869	Mayor, and confirmed by Council...	Clerk, $50 a year..................	Both ....
Toledo.........Ohio	Board of Health.......	7	City limits	35,000	1867	City Council	....	City........
Warren ....Ohio	Board of Health.......	7	City limits	6,000	1872	City Council	....	Both ....
Youngstown....Ohio	Board of Health.......	7	City limits	15,000	1868	City Council	Health Officer and San. Police, $2 or $2.50 per day.	Both ....
Xenia .... Ohio	Board of Health.......	8	Corporate limits...........	7,000	1866	City Council	$2.50 each; Health Officer, $100....	Both ....
Portland.....Oregon	Common Council......	9	City......................	12,000	1851	People...........................	....	....
Altoona..........Pa.	Board of Health.......	3	City......................	14,000	....	City Council	....	City........
Columbia........Pa.	Sanitary Commission..	3	Over the borough..........	8,000	....	President of Council..............	....	Borough....
Philadelphia .....Pa.	Board of Health.......	12	City limits	750,000	1818	Supreme, Dis., and Com. Pleas Court, and City Council (1-3d app. ev. yr.)	....	State ....
Pittsburgh.......Pa.	Board of Health.......	9	City......................	121,485	1851	City Council	....	State ....
Williamsport.....Pa.	....	8	City......................	18,000	1872	City Council	....	State ....
Rhode Island...R. I.	State Board of Health.	......	....	....	....	....	....	....
Providence.....R. I.	Board of Health.......	9	City......................	76,000	1832	Elected by Tax-payers.............	....	State ....

Statistics of Boards of Health in the United States for 1872–73.—(Continued.)

City and State.	What Proportion of the Board are Physicians?	Is the Chief Health Officer selected by or from the Board, or is he appointed?	How often does the Board meet?	Are the Powers of the Board specifically defined or limited by Law?	Has Board a Corps of Assistant Health Officers?	Are they all Physicians?	How many Assistants?	Have they Police Powers?	Has the Board Authority to abate, or only to define Nuisances?	Has Board Authority Independent of City Councils and Police?	Has the Board Power to remove Persons sick with Contagious Diseases to Special Hospital?
Buffalo........N. Y.	None	Appointed by Board	Weekly	Yes	Yes	Yes	Nine	Yes	Both	Yes	Yes, in cases of non-residence.
Cohoes........N. Y.	One	Appointed by Common Coun.	Monthly	Yes	No.				Abate	Yes	Yes.
Elmira........N. Y.	1-6th	Appointed by Council	Weekly	Yes	No.			No.	Abate	Yes	Yes.
Hudson.......N. Y.		Appointed by Council	On call		No.			No.	Define	No.	Yes.
Newburgh.....N. Y.	Two	Appointed	Monthly	Yes	No.			No.	Abate	Yes	Yes.
New York.....N. Y.	Three	From and by the Board	Weekly	Yes	Yes	Yes	21	Yes	Both	Yes	Yes.
Poughkeepsie..N. Y.	Half	Appointed by Common Coun.	Fortnightly	Yes	No.			Yes	Both	Yes	Yes.
Rochester.....N. Y.	None	Appointed by Common Coun.	Weekly	Yes	Yes	Yes		Yes	Abate	Yes	Yes.
Troy..........N. Y.	One		Monthly	Yes	Yes	Yes	One	Yes	Both	Yes	Yes.
Fayetteville....N. C.	One	Appointed	Irregularly	No.	No.	No.		No.	Abate	No.	Yes.
Cleveland......Ohio	Four	Appointed by Board	On call	Yes	Yes	Yes	One	Yes	Abate	Yes	Yes.
Dayton.........Ohio	None	Appointed by Board	Fortnightly	Yes	No.			Yes	Both	Yes	Yes.
Hamilton......Ohio	Three	Appointed by Board	Monthly	Yes	Yes	Yes	Four		Both	Yes	Yes.
Ironton........Ohio	None	Appointed	Every two weeks	Yes	No.				Both	Yes	Yes.
Mt. Vernon.....Ohio	Half	Appointed by Board	When necessary	Yes	1 H. O.	No.	None	Yes	Both	Yes	Yes.
Portsmouth.....Ohio	1-6th	Appointed	No stated meetings	No.	Yes	Yes	One	Yes	Abate	Yes	Yes.
Toledo.........Ohio	Five	By the Board	Monthly	Yes	1 H. O.	Yes	One	Yes	Abate	Yes	Yes.
Warren........Ohio		Appointed by Board	Semi-monthly	Yes	1 M. D.			Yes	Abate	Yes	Yes.
Youngstown....Ohio	Four		Every two weeks		No.		None		Abate	Yes	Yes.
Xenia..........Ohio	One	Appointed by Board	Weekly	Yes	No.	No.		Yes	Abate	Yes	Yes.
Portland.....Oregon		Chief Police is Health Officer		Yes					Both	No.	Yes.
Altoona..........Pa.	All			No.	No.				Define	No.	No.
Columbia........Pa.	1-3d	Appointed	At call of Chairman	No.	No.				Abate	No.	Yes.
Philadelphia.....Pa.	1-3d	Appointed by Governor	Weekly, eight months; and daily rest of year.	For the most part.	No.	No.	None	No.	Both	Yes	If necessary.
Pittsburgh.......Pa.	Five	By Board, but is not a member	Semi-monthly	Yes	No.			Yes	Both	Yes	Yes.
Williamsport.....Pa.	Five		Monthly	Yes	No.				Abate	Yes	Yes.
Rhode Island...R. I.											
Providence.....R. I.		Elected by People	Irregular Intervals	Yes, but very general.				Yes	Abate	Yes	Yes.

Statistics of Boards of Health in the United States for 1872–73. — (*Continued.*)

City and State.	Name of Board.	No. Members of Board.	Bounds within which its Authority is exercised.	Population — Actual or Estimated.	When organized?	By whom is the Board selected?	What Amount of Salary to Members?	Does the Board derive its Power from State or City?
Charleston.....S. C.	Board of Health.......	12	City......................	50,000	1815	City Council......................	City Registrar $1,500..............	Both.......
Galveston.....Texas	Health Inspectors.....	......	Corporate limits...........	25,000	1871	City Council......................	Health Physician, $300; Inspector, $100 per month.	City........
Burlington.......Vt.	....	......	City limits, by H. O........	16,000	1865	....	Health Officer, salary $100.........	City........
Virginia............	State Board of Health.	......	Commonwealth of Virginia.	....	1872	By Governor......................	....	State........
Alexandria.......Va.	Board of Health.......	9	Corporation limits.........	13,000	1804	City Council......................	President of Board, $50 annually...	City........
Lynchburg.......Va.	Board of Health.......	3	City......................	13,000	1871	City Council......................	....	City........
Norfolk.........Va.	Board of Health.......	5	City and Harbor...........	25,000	....	City Council......................	....	City........
Petersburg.......Va.	Board of Health.......	12	Corporate limits...........	20,000	1780	Common Council..................	President $100 per month when attending Small-pox Hospital.	Both.......
Richmond.......Va.	Board of Health.......	3	City......................	60,000	1865	City Council......................	Members, $100, and President $150 per annum.	City........
Parkersburg..W. Va.	Board of Health.......	6	City limits................	6,000	1867	City Council......................	Secretary, $20 per annum..........	City........
Wheeling....W. Va.	Committee on Health..	5	City Corporation..........	25,000	1855	Council..........................	Health Officer receives $800 per annum.	City........
Green Bay......Wis.	....	6	City limits................	6,000	....	Mayor............................	....	City........
Madison.......Wis.	Board of Health.......	4	City......................	10,000	1836	Mayor............................	....	....
Milwaukee......Wis.	Board of Health.......	5	City......................	100,000	1868	Mayor, Common Council concurring	....	State........
Sheboygan......Wis.	Board of Health.......	3	City limits................	7,000	1866	Common Council..................	....	City........

Note. — In these tabulations of returns from Boards of Health, no mention is made of the temporary organization of sanitary authority and duties under temporary health officers or Boards of Health under the general statutes in the several States.

The public health organizations in the cities being based upon special laws, in most instances, the populations of such municipalities have advantages over those of ordinary towns and villages in which sanitary regulations and a vigilant care of the public health are not among the established functions of the local government, but are regarded as of the nature of occasional duties, which are, as a general fact, left to the chance of some public alarm following the actual destruction of life, and the prevalence of dangerous sickness from causes that should have been prevented.

Even in many of our cities, especially in the interior States, there has been an utter failure in municipal organization to provide adequately for a sanitary police and the public health government. Cities which have important commercial and sanitary relations, are, in several of the States, no better off in these respects than the ordinary towns and villages. Even the city of Memphis, Tennessee, which was immediately to be decimated by a preventable pestilence, and Columbus, the thriving capital of Ohio, are examples of this class of

Statistics of Boards of Health in the United States for 1872–73. — (*Continued.*)

City and State.	What Proportion of the Board are Physicians?	Is the Chief Health Officer selected by or from the Board, or is he appointed?	How often does the Board meet?	Are the Powers of the Board specifically defined or limited by Law?	Has Board a Corps of Assistant Health Officers?	Are they all Physicians?	How many Assistants?	Have they Police Powers?	Has the Board Authority to abate, or only to define Nuisances?	Has Board Authority Independent of City Councils and Police?	Has the Board Power to remove Persons sick with Contagious Diseases to Special Hospital?
Charleston ..... S. C.	Three.	Elected by City Council	At call of Mayor	Yes	Yes	None	Three		Both	To large extent.	Yes.
Galveston ..... Texas	All	Appointed		Yes	No	Yes	Two	Yes	Abate	To some extent.	Yes.
Burlington .... Vt.		Appointed by Board		Yes	No				Both	No	Yes.
Virginia	All	By and from the Board	Quarterly	In general terms.	No				Define		Only to suggest the necessity.
Alexandria .... Va.	One	Selected from M. Ds., to poor.	Monthly	Yes		No	None		Both	Yes	Yes.
Lynchburg .... Va.	All	By and from Board	Monthly or oftener	Yes		No	Police	Yes	Abate	Yes	Yes.
Norfolk .... Va.	2-5ths.	Elected by City Council	Weekly in Summer, bi-weekly rest of year.	Yes			One		Abate	Yes	Yes.
Petersburg .... Va.	One	Elected by Board	When necessary	Yes		Two	One	None	Abate	No	Yes.
Richmond .... Va.	All	Appointed	Weekly	Yes	In emergency	Yes		Yes	Both		No.
Parkersburg .. W. Va.	Five	Mayor is Chief	Monthly	Defined					Both	None	Yes.
Wheeling .... W. Va.				Yes	No		One		H. O. Both.		Yes.
Green Bay ...... Wis.	One	Selected by Board		Yes	No	No	None	Yes		Yes	Yes.
Madison .... Wis.			No stated meetings	City Charter					Both	No	With consent of Mayor.
Milwaukee ..... Wis.	Three.	Appointed by Board	Monthly	Yes	No		One		Both	Yes	No.
Sheboygan ..... Wis.		Selected						Yes	Abate	No	Yes.

neglected cities. In reply to my circular of inquiry the following note was appended for Memphis, just before the yellow fever pestilence began its ravages in that city: —

" . . . It is a source of regret to Dr. E——, and other physicians of standing in Memphis, that our city government cannot see the necessity for the establishment of a Board of Health."

It will be perceived that this list does not contain the names of all the large cities of our country, and the reason for this is, the table is made up entirely from responses to circulars sent to cities of over five thousand inhabitants. It is a fact of public notoriety that there are many large cities, as well as some States, that have no organized Boards of Health, or system of registration of vital statistics; consequently, these could not appear in the list. In a few instances no responses to circulars were received.

Although the data here recorded are not flattering either to our national or professional pride; we trust they will serve a good purpose in definitely pointing out our unguarded and dangerous condition from want of competent health organizations to prevent or suppress epidemics, and in fixing a kind of landmark from which in future to trace the progress of sanitary knowledge and its systematic application to the suppression of preventable diseases, and for the preservation of the public health.

Statistics of Boards of Health.

City and State.	What Vital Statistics does the Board register?	Does it require all Children to be vaccinated?	Does it regularly report Causes of Mortality and Records of Deaths?	To whom does the Board report?	How often does the Board report?	In what Form is the Report published?	What Public Water Supplies?
Mobile……Ala.	Births, Deaths, Sex, Nativity	No	Yes	City Gov't and Medical Society	Weekly	Partially. In papers	Waterworks
Selma……Ala.	Births, Deaths, Sex, Nativity	No	Yes	City Council	Irregularly	None	Wells
Tuscaloosa……Ala.							Wells
California	Births, Deaths, Sex, Nativity			Biennially, to State Legislature	Half yearly	Book	
Oakland……Cal.	Births, Deaths, Sex, Nativity	Yes	Yes	To State Board of Health	Monthly	In newspapers	Waterworks
San Francisco…Cal.	Births, Deaths, Sex, Nativity	No	Yes				
Sacramento……Cal.	Births, Deaths, Sex, Nativity	Yes	Yes	Municipal authorities			Waterworks
Stockton……Cal.	Births, Deaths, Sex, Nativity	Yes		Municipal authorities			
Bridgeport……Conn.	None	No	No	Common Council		Not published	Waterworks
Hartford……Conn.	None	Yes		City Council		Not published	Waterworks
New Haven…Conn.	Births, Deaths, Marriages, etc.	Yes	Yes	City Council		Pamphlet	Waterworks
Stonington……Conn.	None	No	No			Not published	Wells
Wilmington……Del.	None	No	No			Not published	Waterworks
Washington…D. C	Deaths	Yes	No	To Pres. U. S. and Gov't District	Annually	Pamphlet	Waterworks and Wells
Pensacola……Fla.		Yes				In the city papers	Wells
Columbia……Ga.	None	No	No	City Council	Monthly	With Council proc'd'gs.	Wells and Cisterns
Savannah……Ga.	Deaths	No	No	To the Mayor	Weekly	In Mayor's report	Waterworks and Wells
Amboy……Ill.	None	No	No	To Council	Monthly		Wells
Bushnell……Ill.	None	No	No	To Council	Quarterly	Newspapers	Wells
Canton……Ill.	None	Yes	No	To Council	Monthly		Wells
Chicago……Ill.	Births, Deaths, Sex, Nativity	Yes	Yes	To Council	Annually	Book	Waterworks
Decatur……Ill	None	Yes		City Council		With Council proceedings.	Waterworks (Holly system).
Galena……Ill.	During epidemics	When ordered	Yes		Monthly		
Joliet……Ill.	None	No	Yes	To Council	Each meeting	Book	Artesian Wells
Monmouth……Ill.	None	When ordered	No	City Council	When necessary	In city papers	Wells and Cisterns
Peoria……Ill.	Deaths	Yes	Yes	Common Council	Annually	Newspapers	Waterworks
Rockford……Ill.	None	Yes	No	Common Council	When required	None	Wells and River
Shelbyville……Ill.	None	When ordered	No	City Clerk	When necessary	None	Wells
Evansville……Ind.	None	Yes	No	City Council	Occasionally	Newspapers	Waterworks
Fort Wayne……Ind.	Deaths	Yes	No		Quarterly	Newspapers	Wells
Goshen……Ind.	None	No	No	City Council	Annually	City papers	Wells

Statistics of Boards of Health. (Continued.)

CITY AND STATE.	Are the Public Water Supplies Pure and Abundant?	Has the City Underground Drainage?	Is it Complete or not.	Are the Streets paved?	Are the Sidewalks paved?	Are the Public School Buildings, Churches, etc., well lighted and ventilated?	Have Experiments been made upon the Purity of the Air in these Buildings?	Altitude of highest Point above Sea Level.	Altitude of lowest Point above Sea Level.	Name and Title of the Person giving this Information.
Mobile .... Ala.	No	No	No	But few	Mostly	Yes	No	20		Dr. E. H. Fournier, H. O.
Selma .... Ala.	Yes	Limited	No	Some	Some	Moderately	No	236	216	C. F. Fahs, M. D., Pres. B. H.
Tuscaloosa ...... Ala		No						300		
California										T. M. Logan, Sec. Sacram'to B. H.
Oakland .... Cal.	Yes	Yes	Yes	Macadamiz'd ½	Macadamiz'd ½	Yes	No	123	Water line	T. H. Pinkerton, M. D., H. O.
San Francisco ... Cal.										Wm. N. Weils, Clerk B. H.
Sacramento ..... Cal.	Yes	Yes	No	A few	No	Partially	No			T. M. Logan, Sec. Sacram'to B. H.
Stockton .... Cal.										T. M. Logan, Sec. Sacram'to B. H.
Bridgeport .... Conn.	Yes	Yes	Incomplete	A few	Yes	Yes	No	69	6½	R. B. Lacey Auditor; E. B. Goodsell, Mayor.
Hartford ...... Conn.	Yes	Yes	Yes	Yes	Yes	Yes	No	110	2	H. C. Robinson, Mayor.
New Haven ... Conn.	Yes	Yes	Yes	No	Yes	Yes	No	140½	4	C. R. Whedon, Clerk of Board.
Stonington .... Conn.	Yes	No		No	Yes	No	No	60	6	
Wilmington ..... Del.	Yes	Limited	Incomplete	Some	Some	Yes	No	110	1–2	G. McCall, Pres. B. H.
Washington ... D. C.	Usually	Yes	Incomplete	Yes	Yes	Yes	No	101	Sea level.	C. C. Cox, M. D.
Pensacola .... Fla.	Yes	No		No	Yes	Yes	No	62	8	T. N. Blount, M. D.
Columbia .... Ga.	Yes	Yes	Yes	No	Partially	Yes	No	270		M. M. Moore, Clerk of Council.
Savannah .... Ga.	Yes	Yes		Yes	Yes	Yes	No			James Stewart, Clerk of Council.
Amboy .... Ill.	Not abundant	No		No	No	Yes	No			Isaac Edwards, Mayor.
Bushnell .... Ill.	Not abundant	Some	Satisfactory.		Yes	Some	No			J. B. Cummings, President, and E. Chesney, Clerk.
Canton .... Ill.	Not abundant	No			Yes	Yes	No			J. L. Murphy, Mayor.
Chicago .... Ill.	Not abundant	Yes	Incomplete	Some	Some	Yes	Yes	616	587	J. H. Rauch, M. D., San. Sup.
Decatur Ill	Not abundant	No		No	Yes	Yes	No	384		M. Forstmeyer, Mayor; G. P. Hardy, Clerk of B. H.
Galena .... Ill.										
Joliet .... Ill.	Not abundant	Partly	Partially	Yes	Yes	Yes	Yes			William E. Henry, Mayor.
Monmouth .... Ill.	Generally	No			Yes	Yes	No	100–150		
Peoria .... Ill.	Yes	Partial	Yes	No	Yes	Yes	No	550	428	E. M. Colburn, M. D., H. O.
Rockford .... Ill.	Yes			Macadamized	Yes	Yes	No			S. G. Bronson, Mayor.
Shelbyville .... Ill.	Yes, not abund.	No			Planked	Yes	No			C. Kelley, Pres. B. H.
Evansville .... Ind.	Moderately	Yes	Yes	Generally	Generally	Yes	No	270–280		G. B. Walker, M. D., President.
Fort Wayne .... Ind.	Yes, not abund.	Yes	Yes	Yes	Yes	Yes	No	137		W. H. Meyer, M. D.
Goshen .... Ind.	Yes	No			Mostly	Moderately	Yes	700	625	M. M. Latta, M. D.

Statistics of Boards of Health.—(Continued.)

City and State.	What Vital Statistics does the Board register?	Does it require all Children to be vaccinated?	Does it regularly report Causes of Mortality and Records of Deaths?	To whom does the Board report?	How often does the Board report?	In what Form is the ep ort published?	What Public Water Supplies?
Indianapolis....Ind.	Deaths	Yes	Yes	City Council		Daily papers	Waterworks and Wells
Laporte.........Ind.	None	No	No	City Council		None	Waterworks and Wells
Logansport......Ind.	None	Yes	No	City Council	Quarterly	In Council proceedings.	Wells
Peru...........Ind.	None	Yes	No	City Council		None	Wells
Richmond......Ind.	None	Yes	No	City Council	Annually	City papers	Wells
Clinton........Iowa	None	No	No	Proceedings published		Official city papers	Wells
Council Bluffs..Iowa.	None	Yes	No	City Council on special cases		Not published	Wells
Fort Madison..Iowa.	None	No	No	City Council, only when Marshal fails to rep't & abate nuisances		With Council proceedings.	Wells
Independence...Iowa.	None	No	No	City Council		Not published	Wells
Marshall.......Iowa.	None	No	No	To the Council		With Council proc'd'gs	Wells and Cisterns
Fort Scott...Kansas.	None	City pays for vaccinating.	No	City Council			
Leavenworth.Kansas.	None	Yes	No	City Council	Monthly	Not published	Wells and Cisterns
Ottawa......Kansas.	None	No	No				Wells
Paola........Kansas.	None	Optional with Patients.	No		Occasionally	In the papers	Wells and Cisterns
Topeka......Kansas.	None	Yes	No	To Mayor and Council		Not published	Wells and River
Louisville.......Ky.	The Board is empowered	All over one year old.	Yes		Weekly and annually.	Newspapers	Both
New Orleans....La.	Deaths	Yes	Yes	To General Assembly of State	Annually	Book form	Waterworks and Cisterns.
Augusta........Me.	None	No	No	City Council			Wells
Bangor.........Me.	None	Yes	No		Annually	With City Reports	Wells
Biddeford.......Me.	None	Yes	No	To City Council	Quarterly	With City Reports	Both
Belfast..........Me.	None	Yes	No	To City Government	Annually	Not published	Wells
Portland........Me.	None	Yes	No	City Council		Report of City Phys.	Waterworks
Baltimore.......Md.	None	Yes	No	Mayor and City Council	Annually	Pamphlet	Waterworks
Massachusetts.......	None	The law requires it.	No	To Legislature	Annually	Book form	Waterworks
Boston........Mass.	By City Register	Yes	Yes	To City Council	Annually	Pamphlet	Waterworks

Statistics of Boards of Health.—(*Continued.*)

City and State.	Are the Public Water Supplies Pure and Abundant?	Has the City Underground Drainage?	Is it Complete or not?	Are the Streets paved?	Are the Sidewalks paved?	Are the Public School Buildings, Churches, etc., well lighted and ventilated?	Have Experiments been made upon the Purity of the Air in these Buildings?	Altitude of Highest Point above Sea Level.	Altitude of Lowest Point above Sea Level.	Name and Title of the Person giving this Information.
Indianapolis.....Ind.	Yes	Yes	Yes	Yes	Yes	Yes	No	726	661	W. S. Darling, M. D.
Laporte........Ind.	Yes	Portions	....	....	Yes	Reasonably.	No	....	....	A. Coleman.
Logansport......Ind.	Yes	In construction	....	Yes	Yes	Yes	No	....	....	J. H. Helm, M. D.
Peru...........Ind.	Yes	Partial	No	Gravel	Stone & Brick.	Yes	No	Average	800	
Richmond.......Ind.	Yes	No	....	Yes	Yes	Yes	No			Charles H. Toll, Mayor.
Clinton........Iowa.	Yes	Yes	No	Partly	Partly	Yes	Yes	50	....	N. D. Lawrence, Mayor.
Council Bluffs..Iowa.	Yes	No	....	....	Yes	Yes	No	1,250	1,000	
Fort Madison..Iowa.	Yes	Yes	Yes	No	Yes	Excellently..	No	664	484	A. C. Roberts, M. D., Mayor.
Independence..Iowa.	Yes	No	....	No	No	Yes, Churches excepted.	No	977	934	O. H. P. Roszell, Mayor.
Marshall......Iowa.	Yes	Partially	No	No	No	Yes	No	750	650	L. W. Griswold, Mayor.
Fort Scott...Kansas.	....	....	....	....	....	....	No	....	....	F. R. Boyle, Mayor.
Leavenworth.Kansas.	Yes	Yes	Yes	Partly	Partly	Yes	No	864	729	S. W. Jones, M. D.
Ottawa......Kansas.	Pure	No	....	Yes	Yes	Yes	No	....	....	H. F. Sheldon, Mayor.
Paola.......Kansas.	Yes	No	No	No	No	Splendid....	They have.	....	....	S. H. Smith, Mayor.
Topeka......Kansas.	Yes	But little	No	....	Yes	Yes	....	932	850	O. T. Welsh, Mayor.
Louisville........Ky.	....	Yes	Incomplete..	Generally	Generally	....	No	....	....	Samuel Manly, M. D.
New Orleans....La.	....	No	....	Partly	Partly	Ch'ches yes, Schools not.	No	17	3	C. B. White, M. D.
Augusta........Me.	Yes	No	No	No	Concreted	Ventilation defective.	No	600	30	J. W. North, Mayor.
Bangor..........Me.	Yes	Main Streets	Incomplete..	Concrete	Concrete	Some	Yes	230	....	Henry Gale, H. O.
Biddeford.......Me.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	300	Sea level.	H. T. Lord.
Belfast..........Me.	Yes	To a limited extent.	No	No	Concrete	Yes	No	197	5	L. W. Pendleton, M. D.
Portland........Me.	Yes	Yes	Yes	Principal Sts..	Yes	....	No	175½	57	H. O. Robinson, City Clerk.
Baltimore.......Md.	Yes	Surface	Yes	Yes	Yes	Yes	No	233 ft. 4 in.	....	H. J. Bowditch, M. D.
Massachusetts.......	Yes	Yes	Fair	Yes	Yes	As good as most places.	A few	....	....	
Boston........Mass.	Yes	Partly	No	Yes	Yes	No	No	244	....	Chas. E. Davis, Jr., Sec. of Board.

Statistics of Boards of Health.—(Continued.)

City and State.	What Vital Statistics does the Board register?	Does it require all Children to be vaccinated?	Does it regularly report Causes of Mortality and Records of Deaths?	To whom does the Board report?	How often does the Board report?	In what Form is the Report published?	What Public Water Supplies?
Cambridge ....Mass.	By City Clerk	Yes	Yes				Excellent Waterworks
Chelsea ....Mass.	None	Yes	No		Weekly	Newspapers	Waterworks
Fall River.....Mass.	None	Yes	No	City Clerk reports to State Board of Health.		None published	Waterworks
Haverhill .....Mass.	None	Yes	No	When called upon by City Council.		Newspapers	Waterworks
Lawrence......Mass.	By City Clerk	Yes	Yes	No special report			
Lowell........Mass.	None	Yes	No	To City Council	Annually	Pamphlet	Waterworks
Lynn..........Mass.	None	Yes	No	To State Board of Health	Weekly	Not published	Waterworks
Springfield....Mass.	None	Yes	No	No reports required			Waterworks and Wells
Worcester.....Mass.	None	Yes	No	City Council, by City Physician	Annually	With city documents	Waterworks
Michigan							
Ann Arbor....Mich.	None	No	No	No report			Wells
Battle Creek...Mich.	None	No	No	As occasion requires		In city papers	Wells
Bay City......Mich.	None	Yes	No	Com. Coun., as occasion requires.			Waterworks
Detroit........Mich.	None	Generally	No	No report		Newspapers	Waterworks
Grand Haven..Mich.	None	Yes	No	At every Session		None	Wells
Grand Rapids.Mich.	None	Yes	No	A record of proceedings is kept	At times	Proceedings	Both
Hillsdale......Mich.	None						
Marshall......Mich.	None	Yes	No				Twenty Artesian Wells
Monroe ....Mich.	None	Yes	No		Semi-monthly	City papers	Wells
Saginaw.......Mich.	None	No	No	To City Council	Monthly		Wells and Holly Waterworks.
Ypsilanti......Mich.	None	Yes	No	Mayor and Council when called for.		Newspapers	Wells
Minnesota							
Duluth ....Minn.	Deaths, Births, and Sex, etc.	No	Yes		Monthly	None	Waterworks and Wells
Minneapolis...Minn.	Deaths, Births, and Sex, etc.	Yes	Yes	To State Board of Health	Quarterly	Daily papers	Waterworks and Wells
Vicksburg......Miss.	Deaths, Births, and Sex, etc.	No	Yes	To Mayor and Aldermen	Weekly	Not published	Wells
Hannibal........Mo.	Deaths	Yes	Yes	To Council	Monthly	Not published	Wells and River
Macon..........Mo.	None	No	No	To Council	Monthly	City papers	Wells
St. Joseph ......Mo.	Deaths	Yes	Yes	To Council	Quarterly	Pamphlet	Cisterns

Statistics of Boards of Health.—(Continued.)

City and State.	Are the Public Water Supplies Pure and Abundant?	Has the City Underground Drainage?	Is it Complete or not?	Are the Streets paved?	Are the Sidewalks paved?	Are the Public School Buildings, Churches, etc., well lighted and ventilated?	Have Experiments been made upon the Purity of the Air in these Buildings?	Altitude of Highest Point above Sea Level.	Altitude of Lowest Point above Sea Level.	Name and Title of the Person giving this Information.
Cambridge .... Mass.	Both	Yes	Yes	Partly	Partly	Yes	No	87	10	Justin A. Jacobs, City Clerk.
Chelsea .... Mass.	Yes	Yes	Yes	Partly	Partly	Yes	No			
Fall River ..... Mass.	Yes	Yes	No		Yes	Most of them.	No	250	Sea level.	L. W. Bowen, M. D.
Haverhill ...... Mass.	So considered	Yes	Incomplete	Partly	Partly	Considered so.	No	200–300 above Merrimac River.		W. S. Chase, Secretary to Board of Health.
Lawrence ..... Mass.										
Lowell .... Mass.	Yes	Yes	Nearly so	Yes	Yes	Yes	No	280	42	N. C. Sanborn, Clerk of Board.
Lynn .... Mass.	Yes	Partly	So far as complete.	Partly	Partly	Yes	No	230		
Springfield .... Mass.	Yes	Yes	No	Partly	Partly	Yes	No	170	40	A. T. Folsom.
Worcester ..... Mass.	Yes	Yes	Yes	Principal Sts.	Yes	Yes	No	748	472	C. Jillson, Mayor.
Michigan										
Ann Arbor .... Mich.	Pure	No		No	Partly	Fairly so	No	890		S. H. Douglas, M. D.
Battle Creek ... Mich.	Yes	Yes	Incomplete	Main Street is.	Yes	Yes	No			G. N. Wakefield.
Bay City ...... Mich.	Not yet	Yes	No	Yes	Yes	Yes	No	650		G. H. Van Etten, Mayor.
Detroit .... Mich.	Both	Seventy-two miles Sewerage.	Yes	Principal Sts.	Yes	Yes	No			Chas. H. Borgman, City Clerk.
Grand Haven .. Mich.	Yes	Yes	Yes		Planked	Yes	No			George E. Hubbard, Mayor.
Grand Rapids .. Mich.	Pure, not abun.	Yes		A portion	A portion	Generally				C. W. Warell, Clerk of Board.
Hillsdale ...... Mich.										
Marshall ...... Mich.	Yes	Yes	No	No	No	Yes				J. R. Ferguson.
Monroe .... Mich.	Yes	Yes	No	Partly	Partly	Yes	No	Average 36 feet above Lake Erie.		H. I. Redfield, Mayor.
Saginaw .... Mich.		Yes	No	No	No	Yes	No	600		A. A. Parsons, President of Board of Health.
Ypsilanti ...... Mich.	Yes	No		No	No	Yes	No	600	120	F. P. Bogardus, Mayor.
Minnesota										
Duluth .... Minn.	Yes	No	No	No	No	Yes	No			E. E. Collins, M. D., H. O.
Minneapolis ... Minn.	Yes	Yes	No	No	No	Yes	No	835	720	Charles Simpson, M. D., H. O.
Vicksburg ..... Miss.	Yes	Yes	Yes	Partly	Partly	Yes	No	280½	50	
Hannibal .... Mo.	Yes	Yes	Yes	No	Yes	Yes	No			J. G. Hickman, M. D., City Phys.
Macon .... Mo.	No	No	No	No	No	Yes	No			George P. Glaze, Mayor.
St. Joseph ...... Mo.	Yes	No		Yes	Yes	Yes	No	190		William W. Brown, City Register.

Statistics of Boards of Health.—(Continued.)

City and State.	What Vital Statistics does the Board register?	Does it require all Children to be vaccinated?	Does it regularly report Causes of Mortality and Records of Deaths?	To whom does the Board report?	How often does the Board report?	In what Form is the Report published?	What Public Water Supplies?
St. Louis, Mo.	Deaths, Births, Marriages	Yes	Yes		Annually	Pamphlet	Waterworks
Omaha, Neb.	None	No	No		No stated time	Not published	Wells and Cisterns
Concord, N. H.	None	Yes	No	To city authorities	Annually	Not published	Waterworks, nearly completed
Nashua, N. H.	None	Yes	No	Mayor and Aldermen	Annually	In city papers	Waterworks and Wells.
Jersey City, N. J.	None	No	No			Newspapers	Waterworks
Millville, N. J.	None	Yes	No	City Council	When required	Not published	Wells
Newark, N. J.	None	No	No	Does not report			Waterworks
Orange, N. J.	None	Yes	No				Wells
Paterson, N. J.	Deaths, Births, Marriages	No	Yes	To City Council	Annually	Not published	Waterworks and Wells.
Auburn, N. Y.	None	No	No	To Common Council		Daily papers	Waterworks
Brooklyn, N. Y.	Births, Deaths, Marriages	Yes	Yes	To Common Council	When necessary.		Waterworks
Buffalo, N. Y.	Deaths	Yes	Yes		Monthly	City papers	Waterworks and Wells
Cohoes, N. Y.	None	Yes	No	To Common Council	Quarterly	City papers	Waterworks
Elmira, N. Y.	None	Yes	No	City authorities	Annually	Papers and pamphlet	Waterworks and Wells
Hudson, N. Y.	None	No	No	Common Council	Annually	With Rep. of C. Coun.	Waterworks
Newburgh, N. Y.	Births, Deaths, Marriages	Yes	Yes		Annually	Pamphlet	Waterworks
New York, N. Y.	Births, Deaths, Marriages	Yes	Yes	To Mayor	Annually	Book form	Croton Aqueduct
Poughkeepsie, N. Y.	None	Yes	No	Common Council	Annually	City papers	Waterworks
Rochester, N. Y.	Deaths	Yes	Yes	Common Council	Annually	Book form	No Waterworks
Troy, N. Y.	None	Yes	No	Common Council	Annually	Pamphlet	Waterworks
Fayetteville, N. C.	None	No	No	No regular reports			Waterworks
Cleveland, Ohio.	None	Yes	No	Common Council	Semi-annually	City Reports	Waterworks
Dayton, Ohio.	Births, Deaths	Yes	Yes	Common Council	Annually	Pamphlet	Waterworks and Wells
Hamilton, Ohio.	Deaths	Yes	Yes	Common Council	Annually	Not published	Wells
Ironton, Ohio.	None	If Board directs.	Yes	Common Council	When ordered	Not published	Waterworks and Wells
Mount Vernon, Ohio.	None	Yes	No	Common Council		Not published	Wells
Portsmouth, Ohio.	None	Yes	No	Common Council	No fixed time	Not published	Waterworks
Toledo, Ohio.	Deaths, Births	Yes	Yes	City Council	Annually	Pamphlet	Waterw'ks now constr'g.
Warren, Ohio.	None. It has power	No	No	City Council		Not published	Wells
Youngstown, Ohio.	None	Yes	No			Not published	Waterworks

Statistics of Boards of Health.—(Continued.)

CITY AND STATE.	Are the Public Water Supplies Pure and Abundant?	Has the City Underground Drainage?	Is it Complete or not?	Are the Streets paved?	Are the Sidewalks paved?	Are the Public School Buildings, Churches, etc., well lighted and ventilated?	Have Experiments been made upon the Purity of the Air in these Buildings?	Highest Point above Sea Level.	Lowest Point above Sea Level.	Name and Title of the Person giving this Information.
St. Louis, Mo.	Yes	Yes	Yes	Yes	Yes	Yes	No	....	....	B. W. O'Brien, M. D., Clerk B. H.
Omaha, Neb.	....	No	....	No	No	Yes	No	....	....	W. M. Brown, Mayor.
Concord, N. H.	Yes	Yes	Incomplete	Yes	Yes	Yes	No	400	250	G. P. Cann, M. D.
Nashua, N. H.	Yes	Yes	No	No	Yes	Yes	No	245	122	Reuben Godfrey.
Jersey City, N. J.	Yes	Yes	Yes	Yes	Yes	Yes	No	....	....	A. L. Cannon, Health Inspector.
Millville, N. J.	Yes	No	....	Yes	Yes	No	No	50	10	George W. Dummett, Mayor.
Newark, N. J.	Yes	Yes	Yes	A few	Generally	Yes	No	213	Sea level.	James Gillin, City Clerk.
Orange, N. J.	Yes	No	No	Partly	Partly	Moderately	No	....	....	Horace Stetson.
Paterson, N. J.	Yes	Yes	Incomplete	Partly	Partly	As usual	No	....	....	E. J. Marsh, M. D., City Physician.
Auburn, N. Y.	Yes	Yes	Yes	Yes	Yes	Very well	No	350	300	Benjamin F. Hall.
Brooklyn, N. Y.	Yes	Yes	Incomplete	Mostly	Mostly	Mostly	No	....	....	A. Otterson, M. D., H. O.
Buffalo, N. Y.	Not always	Yes	Yes	Yes	Yes	Yes	No	687	565	E. C. W. O'Brien, M. D., Health Physician.
Cohoes, N. Y.	Yes	Yes	Incomplete	Yes	Yes	Yes	No	221	20	D. J. Johnston, Mayor.
Elmira, N. Y.	Yes	Yes	Incomplete	Partly	Partly	Yes	No	560	....	Ira F. Hart, H. O.
Hudson, N. Y.	Yes	Yes	Incomplete	Yes	Yes	Yes	No	....	....	C. H. Evans, Mayor.
Newburgh, N. Y.	Yes	Yes	Incomplete	Some	Generally	Generally	No	400	Sea level.	John S. Heard, M. D.
New York, N. Y.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	150	....	Emmons Clark, Sec. B. H.
Poughkeepsie, N. Y.	Yes	Yes	Yes	No	Generally	Not well ventilated.	No	375	Sea level.	E. C. Bolton, Chairman B. H.
Rochester, N. Y.	....	Yes	No	Yes	Yes	Yes	No	....	....	Wm. F. Morrison, Clerk B. H.
Troy, N. Y.	Yes	Yes	Yes	Yes	Yes	Moderately.	No	350	125	John A. Sleicher, Clerk.
Fayetteville, N. C.	Yes	Yes	Yes	Yes	Yes	Yes	No	250	150	W. C. McDuffy, M. D.
Cleveland, Ohio.	No	Yes	Yes	Partly	Partly	Yes	No	732	568	Philip Hutchings, Clerk B. H.
Dayton, Ohio.	Pure, not abun.	No	....	No	Yes	No	No	724	....	Thomas G. Neal, M. D., H. O.
Hamilton, Ohio.	Yes	Yes	Yes	Yes	Yes	Yes	No	592	....	Edward Hughes, Clerk B. H.
Ironton, Ohio.	Yes	No	....	Partly	Yes	Yes	No	....	....	J. W. Corn, Mayor.
Mount Vernon, Ohio.	Yes	No	Yes	Partly	Partly	Yes	No	1,165	963	Joseph S. Davis, Mayor.
Portsmouth, Ohio.	Yes	Yes	Yes	Yes	Yes	Yes	No	470	....	M. S. Pidley, M. D.
Toledo, Ohio.	No	Yes	No	Partly	Partly	Yes	No	....	....	J. W. Skinner, M. D., H. O.
Warren, Ohio.	Yes	Yes	Incomplete	Partly	Partly	We think so.	No	....	....	J. N. Dawson, Mayor.
Youngstown, Ohio.	Yes	Partly	....	Partly	Partly	Yes	No	150 above Lake Erie.	....	S. D. Ranny, Mayor.

Statistics of Boards of Health.—(Continued.)

CITY AND STATE.	What Vital Statistics does the Board register?	Does it require all Children to be vaccinated?	Does it regularly report Causes of Mortality and Records of Deaths?	To whom does the Board report?	How often does the Board report?	In what Form is the Report published?	What Public Water Supplies?
Xenia........Ohio.	Deaths	Yes	Yes...	City Council	Annually	Not published	Wells
Portland....Oregon	None	No	No...	....	....	Not published	Waterworks
Altoona.........Pa.	None	No	No...	City Council	....	Not published	Waterworks
Columbia........Pa.	None	If necessary	No...	City Council	Monthly	In Council proceed'gs..	Waterworks
Philadelphia......Pa.	Births (not nativity), Deaths, Marriages.	Yes	Yes...	To Mayor	Annually and Weekly.	Pamphlets and Papers.	Waterworks
Pittsburgh.......Pa.	Births (not nativity), Deaths, Marriages.	Yes	Yes...	City Council	Annually	Pamphlet	Waterworks
Williamsport........	Deaths	Yes	Yes...	....	Daily	Papers	Waterworks
Rhode Island.......	....	....	....	....	....	....	....
Providence.....R. I.	....	Yes	......	....	....	Pamphlet form	Waterworks
Charleston.....S. C.	None	Yes	......	....	....	....	....
Galveston......Tex.	Births, Deaths, Marriages	No compulsion..	Yes...	City Council	Weekly	City papers	Cisterns
Burlington.......Vt.	None	No	No...	City Council	Annually	In City Annual Rep....	Waterworks and Lake ..
Virginia............	None	Yes	No...	To Legislature	Annually	As State documents....	....
Alexandria......Va.	None	Yes	No...	To City Council	Annually	Proc'd'gs of City Coun.	Waterworks
Lynchburg.......Va.	Deaths	Yes	Yes...	To City Council	Monthly	Daily papers	Waterworks
Norfolk.........Va.	Deaths	Yes	Yes...	....	Monthly	Not uniformly	Cisterns & Wells. Waterworks nearly complet'd.
Petersburg......Va.	None	Yes	No...	To City Council.	When necessary.	....	Waterworks, Aqueduct, Wells, Springs.
Richmond.......Va.	Births, Deaths	Yes	Yes...	To City Council	Annually	Pamphlet	Waterworks and Wells..
Parkersburg..W. Va.	None	No	No...	To City Council	Monthly	Not published	Wells
Wheeling....W. Va.	None	Yes	No...	To City Council	Annually	Pamphlet	Waterworks
Green Bay.....Wis.	None	No	No...	To Mayor and Council	....	....	River
Madison........Wis.	None	No law requiring it.	No...	Council	Monthly	Proceedings of Council.	Wells
Milwaukee.....Wis.	Deaths	Voluntary	Yes...	Council	Annually	Pamphlet. Monthly paper.	Wells & Cisterns. Waterworks now erecting.
Sheboygan.....Wis.	None	No	No...	Council	Monthly	Not published	Wells

Statistics of Boards of Health.—(Continued.)

City and State.	Are the Public Water Supplies Pure and Abundant?	Has the City Underground Drainage?	Is it Complete or not?	Are the Streets paved?	Are the Sidewalks paved?	Are the Public School Buildings, Churches, etc., well lighted and ventilated?	Have Experiments been made upon the Purity of the Air in these Buildings?	Altitude of highest Point above Sea Level.	Altitude of lowest Point above Sea Level.	Name and Title of the Person giving this Information.
Xenia.........Ohio.	Yes	No		Yes	Yes	Yes	No			J. M. Keever, Mayor.
Portland.... Oregon.	Yes	Partly	No.	No	No			180–200		W. S. Calduin, Auditor, etc.
Altoona.........Pa.	Yes			No	Principally	Tolerably	No	1,350	1,200	William R. Finley, President.
Columbia........Pa.	Yes	No		Yes	Yes	Tolerably	No			C. Hershey, A. Craig, J. W. Steady, [San. Com.
Philadelphia......Pa.	Yes	Yes	Yes	Yes	Yes	Yes	No	440	6 ft. below high water.	J. E. Addicks, H. O.
Pittsburgh.......Pa.	Pure, but not sufficient.	Some	Incomplete	Partly	Partly	Yes	No	1,312	740	Crosby Gray, H. O.
Williamsport.....Pa.	Yes	Yes	Defective	Main streets	Main	Yes	No			E. P. Dietrich, City Clerk.
Rhode Island.......										
Providence.....R. I.	Yes	Yes		Main streets	Main	Very few	No	200	Sea level.	E. M. Snow, M. D.
Charleston.....S. C.		Yes	No	Partly	Partly	Yes	No	19	6	George S. Pelzer, M. D.
Galveston......Tex.	Yes	No		No	No	No adaptat'n	No	4 ft. 8 in.		George M. Peete, Health Phys.
Burlington.......Vt.	Yes	Partly	No	Partly	Partly	Admi'bly so.	No	415		H. H. Langdon, H. O.
Virginia...........						Yes	No			L. B. Edwards, M. D.
Alexandria.......Va.	Abundant	Partly	No	Yes	Yes	Yes	No	44	2	J. B. Johnson, M. D.
Lynchburg......Va.	Yes	Yes	Incomplete	Partly	Partly	Admirably adapted.	No	814	507	R. S. Payne, M. D.
Norfolk..........Va.	Will be	No	No	Many are	Many are	Yes	No	10	Water line	L. D. Grashe, Pres. of Board.
Petersburg.......Va.	Yes		Could be improved.	The principal	The principal	All in modern styles.	No	94.42		Charles F. Couch, M. D.
Richmond.......Va.	Pure	Yes	No	Partly	Partly	Yes	No	185.7	7.5	J. G. Cabell, Pres. of Board.
Parkersburg..W. Va.	Yes	No	No	Generally	Generally	Well adap'd.	No	700	650	E. D. Safford, M. D.
Wheeling....W. Va.	Yes	Yes	Incomplete	Many	Many	As in most cities.	No	840	625	S. L. Jepson, M. D.
Green Bay......Wis.	Not pure	No	No	No	No					Charles Reynolds, Sec. of Board.
Madison........Wis.	Yes	No		Generally	Generally	Schools, not Churches.	No	150	125	James L. Hill, Mayor.
Milwaukee......Wis.	Yes	Now constructing		Partly	Partly	Equal with others.	No	500		James Johnson, M. D.
Sheboygan......Wis.	Yes	No		No	No	Yes	No	60 ab. lake.		T. M. Blackstock, Mayor.

A REPORT UPON THE NECESSITY FOR A NATIONAL SANITARY BUREAU.

By CHRISTOPHER C. COX, M. D., LL. D.,

President of Board of Health, Washington, D. C.

The history of ancient nations shows that sanitary measures for the protection of public health were among the earliest subjects of inquiry. The relics of Egypt at this day, are replete with interest in this connection. The constant changes of the soil produced by the periodical inundations of her principal river, prevented permanent burial of her dead, and hence the practice of embalming the human body and thus arresting putrefaction.

The lakes of Moeris, which drained the marshy surface, thus diminishing miasmatic exhalations, also serve to point a commendable regard, in that early period of time, for the sanitary needs of the population. The *Cloaca Maxima* of ancient Rome is the first great sewer on record, and achieved an important work in draining portions of the city, then marshy and untenantable, but subsequently constituting the foundations of some of the noblest public structures. On the site of what was then a pestilential bog stands to-day the mighty Coliseum, the vast amphitheatre of Vespasian. No city of modern times, it may be safely asserted, has been so liberally flooded with pure water, as was Rome. The remains of her mighty aqueducts indicate a sagacity and persevering energy rarely paralleled in any age or by any people. I omit mention of her splendid baths, and other important appliances for the maintenance of public health.

The Middle Ages were characterized by a gross neglect of sanitary laws, and as the legitimate fruit of this apathy, epidemics of every description and violence ran riot. Since then the science of Public Hygiene has been steadily advancing, and has constituted an important branch of medical education on the European continent. One of the grandest illustrations of well directed energy in reclaiming a sickly district, is the city of St. Petersburg, Russia, which was built on a low marsh, near the mouth of the Neva. The drainage of this site of a great city was accomplished by Herculean labor, and no trifling loss of human life. To-day it contains its hundreds of thousands of inhabitants, and ranks with the healthiest, as it is one of the most magnificent of modern cities.

We have cause for congratulation that in no part of the world is the subject of Sanitary Science, in all its practical relations, attracting more attention than in our own country. Over the entire land are to be found well organized Health Boards, either State or municipal, represented by men of science and comprehensive views, and each in its sphere doing a great work, destined to protect more than ever the health of the people.

Nothing is more certain than that sanitary measures faithfully carried out must result in improved health and prolonged life. Vital statistics establish the importance of hygienic precautions in promoting soundness and longevity.

"The mortality in Paris," says John Bell, "in the early part of the fourteenth century, has been estimated to be one in twenty; whereas the average mortality of that city in the very poorest ward, in which poverty and destitution are extreme, was one in twenty-four, in the first third of the present century. The mortuary statistics of Geneva have been often quoted as illustrative of the advancement of sanitary science and the healing art. In an annual address, delivered more than twenty years ago, before the New York State Medical Society, and members of the Legislature at Albany, by Dr. Alexander H. Stephens, the increased duration of human life in modern times is thus demonstrated.

"In the city of Geneva, in the sixteenth century, one individual in 25 died annually. For the eighteenth century, one in 34; at the present time one in 46. With us the mortality is greater. I estimate it at one in 40, the proportion of children being larger, and childhood being the period of the greatest mortality. In the British navy among adults, none of whom are very aged, the mortality is only about one in 100. Seventy years ago the mortality in the British navy was one in every 10. In 1808, one in 30; 1836, $13\frac{9}{10}$ among 1,000 — a diminution to less than a seventh of the rate in 1770. In the American army, with a corps of medical officers, not excelled by that of any other country, the mortality is little over two in 300 per annum. In London, the mortality in the middle of the last century, was one in 32. In the year 1838, the mortality was one in 36. Within the last twenty years the mortality of Russia has been one in 27; Prussia, one in 36; France, one in 39.07; Holland, one in 39; Belgium, one in 43.01; England, one in 43.07; Sicily, one in 32; Greece, one in 30; Philadelphia, one in 42.03; Boston, one in 45; New York, one in 37.83."

These statistics, and those of more recent date, which might be quoted, are full of interest, and indicate the prodigious strides which have been made, both in hygiene and practical medicine. The importance of carefully prepared tables in connection with every branch of public hygiene cannot be over-estimated. Among these may be prominently mentioned statistics of mortality, of reproduction, of sickness, accidents, and infirmity, of dwellings, of food, of animal life, and other subjects of vital importance in relation to health.

Important as is the preservation of health and prevention of disease, both in regard to individuals and communities, and early as the subject forced itself upon human attention, public hygiene never, until a comparatively recent period, assumed its deserved position, or became entitled to consideration as a distinct science. The frequent and terrible invasions of epidemics, and the occasional increased violence of endemic maladies, stimulated energy and research in the discovery of suitable means to prevent or modify the ravages of these relentless foes to health and life. The public mind became imbued with the imperative demand for such measures.

Boards of Health were everywhere established, the results of whose labors have been largely aided by successful researches in the kindred sciences of physiology, pathology, and chemistry. Who at this day questions the value of these local organizations?

The idea of a central bureau of health is not perhaps altogether original with the author of this essay. More than fifteen years ago, an able treatise was issued from the English press, by Henry W. Rumsey, entitled "Essays on State Medicine." The original design of the work comprehended the establishment of a Central Sanitary Board under government direction. The scope of the treatise was at first very extended, embracing the "bearings of preventive medicine upon the several questions of general legislation, as education, public works, popular representation, agriculture, commerce, etc., and to inquire how far hygienic principles had been, or might be recognized in the framing or execution of various measures of national inquiry and reform." Since the publication of this work, England has organized a central health department, and is now seriously contemplating a ministry of public health. Prussia, under the direction of Bismark, is engaged in similar movements, while Germany has been long distinguished for her comprehensive national health code. The object of these efforts in Europe is what we desire to accomplish in this country, namely, the collection of the largest amount of correct information upon every subject connected with the public health, and sow it broadcast over the land, for the benefit of the whole people.

Regarding the constantly increasing sanitary wants of our country, its extensive geographical area and varieties of climate, its climatic zones marked by certain morbid peculiarities and endemic diseases, its hydrology, the thousand agencies and influences threatening its soundness, it occurred to me that our Government should advance among the first to conserve the health of its population, and avert the disasters which menace it. With this view, I prepared in 1871 the plan of a national bureau of health. This was subsequently submitted, as you are aware, at a meeting of sanitarians, representing the different sections of the country, assembled at New York, and indorsed by them in a series of commendatory resolutions. Since then an "American Health Association" has been organized, embracing in its membership the leading scientists and sanitarians of the United States and Canada; and at their last meeting, a special committee, of which I am chairman, was appointed to report upon the "necessity for a national sanitary bureau." I allude to these facts for the purpose of showing that I have not urged this subject prematurely before Congress, but after full and earnest interchange of views with others whose high standing entitles their views to credit and respect.

At the last session the following bill was presented to the Senate, by Hon. Mr. Patterson, of New Hampshire, and referred to the Committee on Education and Labor. Little effort was made to pass the measure through Congress, preferring as I did, to leave it until the coming winter, with the hope that in the recess additional friends and agencies might be rallied to its support. It is proper to state that thus far it has encountered little op-

position. On the contrary it has the approval of many of the most intelligent of both Houses of Congress, and will at the proper time receive their earnest advocacy and support.

The bill alluded to is entitled "A Bill to establish a Bureau of Sanitary Science," and is as follows : —

"*Be it enacted by the Senate and House of Representatives of the United States in Congress assembled*, that there shall be established at the seat of Government of the United States, and attached to and under the direction of the Department of the Interior, a bureau, to be denominated a National Sanitary Bureau, the general design and duties of which shall be to acquire and diffuse among the people of the United States useful information on subjects connected with the preservation of the Public Health, and to aid in the establishment and management of efficient sanitary and quarantine systems and regulations throughout the several States and Territories of the United States.

"Section 2. That there shall be appointed by the President of the United States, by and with the advice and consent of the Senate, an officer to be known as the Commissioner of the National Sanitary Bureau, who shall be the chief executive officer of said bureau, and who shall receive for his compensation a salary of ——— dollars per annum.

"Section 3. That it shall be the duty of the Commissioner of the National Sanitary Bureau to acquire and preserve in his bureau all information which he can obtain by means of books and correspondence, and by practical and scientific experiments (accurate records of which experiments shall be kept in his office) by the collection of statistics, and by every other means in his power, concerning the following subjects :—

"Medical geography, including climates, marine or littoral, upland or inland, mountain; their diseases, including thoracic and glandular zone, intermittent zone, gastric zone; hydrology, including saline, alkaline, chalybeate, hot springs.

"Diseases of animals and cereals, including cattle plague, rot in sheep, cerebro-spinal meningitis in horses, rust in wheat, potato rot, rye and corn fungi, with soil analyses.

"Diseases of artisans, from in-door confinement, overcrowding, and absence of sunlight, from contaminated atmosphere by mechanical impurities (cotton, wool, dust, etc.), from chemical impurities (mechanical vapors, arsenic, phosphorus, lead, and various pigments); diseases of other callings and professions.

"Certain zymotic diseases, including typhus, scarlatina, rubeola, their causes and prophylaxis; small-pox, cholera, yellow fever, including causes, prophylaxis, or modification; investigation of all questions bearing upon vaccination, as a preventive or modifier of small-pox; the adoption of suitable means of procuring, preserving, and distributing to physicians and public institutions, free of charge, vaccine matter of unquestioned purity; the investigation of cholera and yellow fever, their causes and prevention; and the collecting, digesting, and distributing information on these subjects.

"The registration of mortuary statistics, including color, sex, race, etc.

"The causes of disease, including the nature of disease germs, aerial, animal, and contagious.

"The best means of preventing the ingress of foreign epidemics, and of extending aid to State quarantines. The proper sanitary condition of various modes of public conveyance on land and water.

"Sewerage and nuisances in general. Proper sanitary regulations as to the transportation of persons affected with contagious diseases.

"The sanitary condition of public schools, hospitals, charities, manufacturies, etc.; and proper regulations for the preservation of health therein, including hours of study, in proportion to age, air, space, ventilation, heat, light, vaccination, etc.

"Unwholesome food and drink, with the means of preventing and correcting the use of the same.

"Chemistry, microscopy, mechanics in their relations to various subjects of investigation.

"The collection of a library for said bureau, to consist of standard works on all subjects of Public Hygiene; reports of Boards of Health, Superintendents of Quarantine, Public Officers, and others on sanitary matters; pamphlets, essays, original papers, etc.

"Section 4. That it shall further be the duty of the Commissioner of the National Sanitary Bureau to make annually a general report in writing of his acts to the President and to Congress, in which he may recommend the publication of papers forming part of, or accompanying his report; to make special reports on particular subjects whenever required to do so by the President, or either House of Congress, or when he thinks the public necessity demands it; to direct and superintend the expenditure of all moneys, appropriated by Congress for the support of said bureau, and render full and accurate reports thereof; and the said *Commissioner may send and receive through the mails*, free of charge, all communications and other matter pertaining to the business of his office, not exceeding in weight thirty-two ounces. [This was written before the law abolishing the franking privilege.]

"Section 5. That there shall be appointed for duty in said National Sanitary Bureau whatever additional officers are required, including a chief clerk, chemists, experts, etc., whose salaries shall be ———, and who shall, together with the Commissioner, give bonds for the faithful performance of their duties."

In this plea for the public health, it seems wholly unnecessary to enter upon any elaborate argument as to its importance. Few will have the hardihood to call in question the vital necessity of preserving the health of the nation, upon which, in no small degree, depends its mental and moral elevation in peace, as well as its prowess and renown in war.

While true that local health boards have done much, and able sanitarians have been earnest in their work, it cannot be denied that the country needs a grand central institution which shall give direction, by its investigations and results, to subordinate sanitary labors. The Bureaus of Education and Agriculture suggest, in order to render the arrangement symmetrical and perfect, a Bureau of Sanitary Science, representing the skill, ability,

and learning of the nation in a trained corps of officers and experts, who shall devote themselves exclusively to the advancement and success of their respective departments. A scientific national organization is needed for the general record of statistics bearing in any degree upon the public health and safety; to determine the causes of disease and mortality, and the relative value of the several ascertained causes in producing debility and deterioration of the race; to examine into the comparative influence of various trades and occupations upon health and longevity, including the maladies and injuries peculiar to special occupations, and their relative ulterior effect upon families and posterity, as well as all known circumstances and precautionary expedients which have been or may be found to lessen the hazard of insalubrious employments, rendered more necessary by constantly developed new arts and industries demanded by the progressive spirit of the age; to examine into the nature, quality, and variety of ordinary diet, the best method of preparing and preserving victuals, the liability to vitiation, deterioration, or adulteration of food, and the means of correcting these mischiefs; to determine the comparative advantages of various kinds of nutriment and beverage under differing circumstances, or to show what, on the whole, conduces most to the bodily soundness and efficiency of the laboring classes; to carefully investigate climate and meteorology, inquire how the various phenomena and climatic conditions embraced under these heads influence the structure and life of man, and thus deduce the best means of preventing disease and prolonging the term of human existence; to inquire into the history, nature, and cause of epidemics, collect facts and opinions respecting their origin, diffusion, severity, duration, and, from a thorough investigation into all modifying conditions and circumstances, teach the best method of preventing or rendering less aggravated the spread of these formidable maladies; to collect and carefully record all facts of importance in connection with vaccination as a preventive of small-pox, and also to procure and promptly distribute to physicians and public institutions throughout the United States, free of charge, vaccine matter of unquestioned purity; to collect all information of value in reference to the diseases of animals and cereals; to collect, arrange, and distribute statistics of mortality, of reproduction, sickness, accident, and infirmity; to register the temperature, pressure, tension, elasticity, humidity, and ozone of the atmosphere; to consider the ventilation and purification of dwellings, public buildings and towns, the removal of nuisances, the water supply, drainage and sewerage; the safety of navigators and emigrants; proper construction, ventilation, heating, and hygienic regulations of hospitals, and public charities.

These constitute some of the principal topics to be considered by the proposed Bureau. The people should be educated by the unreserved publication of facts and discoveries affecting health, and to this end we need a comprehensive system of inquiry by a corps of trained, experienced, and unbiased scientific observers, acting under the generous support and direction of a liberal and beneficent government.

The value of the labors of such a Bureau cannot be computed, embracing,

as they will, topographical, meteorological, mortuary, reproductive statistics, as well as those having reference to food, its production and consumption, epidemic and zymotic diseases, and many other subjects of great sanitary moment. The regulation of quarantine by preventing the ingress of foreign epidemics, and the extending aid to State quarantine, are among not the least of its important provisions; while its effect in vitalizing the various health boards of the country, harmonizing their plans of operation, and diffusing practical information among the people, cannot fail to exert a powerful influence upon the public health.

Among the measures of practical importance proposed by it, is the production and preservation of pure vaccine virus, and its liberal distribution, free of charge, to all parts of the country. This feature in itself would compensate in its results for the labor and expense of constructing the Bureau. The field of its usefulness is indeed most extensive, and cannot be thoroughly comprehended by any brief discussion of its merits.

No institution, however valuable, escapes opposition, and hence there are to be found those who enter objections against the establishment of a Sanitary Department under direction of the Government; but the opposition is exceedingly limited, and by no means virulent. The admitted importance of the objects proposed, silences the spirit of antagonism. Its great purposes command respect; they come home to every man's fireside, to his own person, and enter appeals in its behalf which cannot, and will not be successfully resisted. A prominent objection urged is the old one, that the General Government has no right to assume to do what belongs exclusively to the States, or to encroach upon their exclusive legislative powers. The same argument was fiercely arrayed against the establishment of a Bureau of Agriculture, and more recently that of Education. In what respect does either of these Bureaus interfere with State legislation? It is clear that they furnish aid to the States, contributing largely to their prosperity. What a flood of useful information on the subjects committed to them do not these government institutions diffuse annually among the people, and where will you find an intelligent agriculturist or educationalist who would be willing to have either of these abolished, because of any fancied interference with that sensitive bugbear, "State rights"? The object of the Sanitary Bureau would be chiefly one of supervision, and the diffusion of information upon subjects intimately allied to the physical health, mental development, and consequent prosperity and happiness of the nation.

And yet there would seem to be exigencies in which the interference of Government must be regarded as an admitted duty, for the same reason which justifies the maxim "*inter arma silent leges*," when the Republic is in danger. When, for example, cholera, rinderpest, or any other fearful epidemic, sweeps through the land, and the essential precautions are neglected by some of the States to the great peril of the rest a general law protecting the people of all the States, by preventing the transportation of diseased cattle and other sources of contagion, will not only conserve the public safety, but relieve the State of enacting what might be regarded as an unjust and odious statute by the parties aggrieved. Talk of State rights

and such a connection! It is the right, forsooth, to suffer ourselves, and to inflict disease upon others, versus the unauthorized exercise of power, if you please, to prevent both calamities. An able article which appeared some months ago in one of the papers of this city, in vindication of the National Sanitary Bureau, from the pen of an accomplished Hygienist (Dr. J. R. Black), who has made a number of valuable contributions to the "Science of Health," thus alludes to the objection that this Bureau would require authoritative legislation. "That," says the Doctor, "is precisely what is needed to protect the people of the United States against some horrible pestilences which are brought upon our shores every few years. If we had had enlightened legislation, with prompt and decisive measures a few years ago, when cholera made its appearance in the East, the Western, as well as the Eastern cities would have been spared the infliction, or at least in none of them would it ever have assumed the proportions of an epidemic. Cincinnati would not have been scourged, her trade paralyzed, and untold misery and anguish brought upon her people. That epidemic, from the lack of sanitary authority, and of intelligent, coöperative action, such as experts only can give, cost you more in six months than a Sanitary Bureau would cost in a hundred years. Had these things been, you would then have known, too, that sanitary science was capable of stamping the disease out as was done years ago by Pettenkofer in several towns of Germany; by Budd in Bristol, England; Dr. E. Harris in New York, and Hamilton on Blackwell's Island. Hampered as these sanitarians were by want of authority, they yet succeeded in completely stamping out the disease in a very short time, except in New York, where fresh cases were brought into the city almost every day, with the conditions extremely favorable for its extension, and yet the disease was kept down by the efforts of the Sanitary Board, and never became epidemic. In a letter from Professor F. H. Hamilton, he states that he asked of the Commissioners of Blackwell's Island for complete control of the island for four days, in which period he promised to extinguish the cholera there, a promise which he successfully accomplished, as the Commissioners have acknowledged over their signatures.

"A remarkable illustration of what sanitary scienceis capable of accomplishing when backed by authority, was shown during the late war, in the Department of the Gulf, under the command of General Butler. During the occupation of New Orleans by the Federal forces, for more than two years, although about one hundred thousand unacclimated soldiers were stationed, or passed through the city, not a single case of yellow fever originated among them. The permanent residents of the city were astonished at a salubrity and an exemption from fever, such as they had never before known. Ignorant and corrupt municipal authorities had a practical exhibition of the wonders a little vigor and knowledge can perform, when properly directed. To those familiar with sanitary matters, it appears singularly disgraceful that the laws of our land do not put into practical operation the most elementary principles of hygiene, by protecting the community against preventable infectious diseases. A few individuals, a

few towns, or a few cities, a few states, cannot protect themselves in this era of rapid intercommunication. The times are changed, the world progresses, and wise legislators will not overlook the one, or neglect to recognize the other, even if timid conservatives and blatant politicians cry out with anger at every step the world makes forward."

It is gratifying to know that the plan of a National Sanitary Bureau has been approved by prominent sanitarians in every part of the country, as is evident from the hearty indorsements which have from time to time appeared in the public press. Among these I may be allowed to mention that of our own talented and widely esteemed President, Dr. Stephen Smith, who thus alludes to the subject in a letter to the "New York Evening Post." Like everything he writes the communication is terse, intelligible, and to the point. "I know nothing," he remarks, "of Senator Patterson's bill, except what recently appeared in a morning paper, but judging from that of its general scope and purpose, I have no doubt of its importance. A Bureau of Public Health in the Interior Department, devoted to the collection of information in regard to the diseases peculiar to localities and their local causes, and of the progress, course, and prevalence of contagious diseases and epidemics abroad and at home, and the diffusion of such information among Boards of Health in all parts of the country, and among the people at large, would be of incalculable value. Such a bureau could furnish accurate information to every citizen as to the diseases peculiar to any locality in the United States to which he was about to remove. It could, as in England, by its timely advice, secure the coöperation of all the health authorities of the country in the adoption and execution of measures of protection against approaching or prevailing epidemics; and finally, by its daily information of the location and progress of pestilential diseases, it could forewarn communities which lie in their course and enable them to make timely preparation against the invasion of these scourges. Epidemics like cholera, yellow fever, etc., have as fixed laws governing their course and progress as the storms, and a central bureau at Washington, as accurately informed of the daily progress of such epidemics, as the Signal Service Bureau is of the course and progress of storms, could with quite as much accuracy foretell their appearance at a given locality. The late epizoötic among horses spread over the country by easy but definite stages, like a wide reaching storm; in its progress it was governed by what was peculiar to that class of epidemics, and which could be determined by means of as accurate observation, as are employed in determining meteorological phenomena.

"A bureau which could thus display its 'danger signals' of approaching pestilences, and by enabling communities to make suitable preparation, could arrest the progress of the hordes of roving epidemics which decimate our cities and villages, would certainly be of a pecuniary value equal to the cost of sustaining such a service. Whatever may be the fate of this attempt to organize in the General Government a department devoted to the preservation of the public health, by the collection and diffusion of information

relating to our indigenous diseases, and of the epidemics which so frequently overrun the country quite unobstructed, the day is not distant, when the public sentiment of the United States, as of Great Britain, will demand that the measures for promoting the health of the people shall not be less effectual than those promoting agriculture and education."

I cannot conclude this part of my subject without referring with unusual gratification to an admirable address on the importance of sanitary science, and some of the relations of the medical profession to education by Dr. C. R. Agnew, President of the Medical Society of the State of New York. It is cheering to find a representative member of the medical profession of Dr. Agnew's high character and standing, boldly asserting the importance of Public Hygiene, and urging the earnest coöperation of physicians in the great work so nobly presented by the various health boards of the country. He alludes to the various reports of the health associations of the different States and cities as evidence of the rapid development of Sanitary Science. After alluding to the course of sanitary legislation in Europe and his own State, he invokes the earnest labor of the country Medical Associations, and insists that every county society should have an able, industrious standing committee constantly at work gathering knowledge of the health questions affecting the neighboring populations, so that out of the combined labors of these societies, and the inevitable effect produced upon the popular mind, would grow an influence guided by intelligence, that would soon bring every rural district, hamlet, town, and city under the life saving operation of adequate legislation. In referring to the effort to establish a National Sanitary Bureau, he remarks : —

"It is a most cheering indication of progress to know that a bill has been introduced into the Senate of the United States, for the establishment of a Bureau of Sanitary Science."

"We would recommend," he continues, "that this society take becoming action to express its approval of so desirable a measure, and by such expression of approval, if by no other means, give willing aid to the grand object which the act has in view."

The committee of the society appointed to consider such portions of the introductory address of the President, as suggested action on the part of the society, in regard to hygiene, after urging compliance with his valuable recommendations, says "as a legitimate sequence of the growth of such a system in the collection of facts, a central bureau at Washington will give more authorized expression to such principles."

In concluding this paper I feel painfully sensible of the imperfect manner in which the claims of the subject have been presented. Indeed little more has been accomplished than to furnish for your consideration the outlines of the plan, and the arguments of others rather than my own. Fortunately the value of a National Health organization is so apparent, and appeals so directly to the good sense of every intelligent and humane citizen of the land, that an attempt to argue its importance seems wholly unnecessary.

In preparing the bill now before Congress, I can truthfully aver, that I have been prompted by no interested motives, but an earnest desire to pro-

mote the health, and consequent prosperity of the nation. I sincerely believe no more important measure can occupy the attention of Congress. The establishment of such a department will reflect credit upon our legislators, upon the administration under whose rule it is inaugurated, and result in untold blessings to the country, and indeed to the whole civilized world.

IX.

WATER SUPPLY OF CITIES.

REPORT UPON THE SANITARY CHEMISTRY OF WATERS, AND SUGGESTIONS WITH REGARD TO THE SELECTION OF THE WATER SUPPLY OF TOWNS AND CITIES.

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THE water supply of towns and cities may be derived from wells, ponds, or rivers.

Wells are either shallow or deep. Shallow wells are usually *open*, from ten to sixty or more feet in depth, and from three to ten feet in diameter. Recently, shallow closed "tube" or "driven" wells have become quite popular in many localities. These wells are obtained by driving an iron tube, an inch or more in diameter, into the ground, till a water-bearing stratum is reached. A pump is then attached and a supply of water is pumped up through the tube.

Deep or artesian wells are bored through successive strata often many hundred feet, and even one or two thousand feet deep; the water either flowing from them spontaneously or being raised by pumping.

I. NATURE OF THE IMPURITIES CONTAINED IN WATER.

1. SPRING WATER. — Water being a great solvent, dissolves to some extent, whatever it comes into contact with. Even atmospheric waters, the rain and melted snow, are not pure. Rain, as it falls through the air, washes out the solid particles of dust, and the germs of animals and plants. And in addition to these it dissolves the oxygen, the nitrogen, carbonic acid and ammonia of the atmosphere, — a greater proportion of the oxygen than of the nitrogen. The air which is dissolved in water is much richer in oxygen than ordinary atmospheric air. The absolute quantity is very small. Twenty-five cubic feet of water take up only one cubic foot of oxygen.

Water which is collected from roofs in the city is never pure. It contains gases which are only developed in cities, sulphur compounds, products of the combustion of coal, chemical operations, etc. After thunder-storms, the rain water is always found to contain minute quantities of nitric acid produced by the electric discharges, which cause the oxygen and nitrogen of the air to unite. Rain water almost always contains a little organic matter, causing it to become putrid when kept for some time.

Terrestrial waters are always impure. Rain falling upon the earth's surface is absorbed by the porous soil, and the materials of which the soil is

composed being to a greater or less extent soluble, the water becomes contaminated with mineral matter. The character of spring water, therefore, depends upon the character of the soil through which it has passed before it issues as a spring. In New England, where the rocks are granitic, and the minerals chiefly quartz, feldspar, and mica, water is extremely pure. But in limestone countries, where carbonate of lime and magnesia abound, we find the spring waters largely contaminated with these substances. These carbonates are rendered soluble in water by the carbonic acid present, which forms bicarbonates with them. To such solutions of bicarbonate of lime are due many curious phenomena in nature.

On boiling solutions of bicarbonate of lime and magnesia, the excess of carbonic acid is expelled, and the carbonates having no longer a solvent are precipitated. In this way incrustations are formed in tea-kettles and steam boilers.

Spring water is generally very clear, although it may be quite impure. It holds its impurities in solution. The soil through which it has passed, although it has conferred upon it its impurities, has at the same time filtered it, and thus rendered it clear and sparkling. As it comes from below the surface, it is generally cool. For these reasons spring water has always been highly prized.

Ordinary spring waters always contain salts of the alkalies and alkaline earths : chlorides, sulphates, and bicarbonates of potassa, soda, lime, and magnesia. The most common salts are the chlorides of potassium and sodium, the sulphates of soda and lime, and the bicarbonates of lime and magnesia.

Besides these alkaline and earthy salts, we almost invariably find silica, the substance of quartz, to the amount of a grain or less in a gallon. The total quantity of dissolved impurities in ordinary spring waters varies from one or two grains to eighty or ninety grains in one U. S. gallon of two hundred and thirty-one cubic inches.

Hard and Soft Waters. — Lime salts in water are the cause of what is called *hardness*. They decompose the soap used in washing, forming a flocculent insoluble compound, and destroying its detergent properties. In Glasgow, the saving to the people in soap, due to the introduction of the pure water of Loch Katrine, in place of the hard well waters previously used, is said to amount to one hundred and eighty thousand dollars per annum.

As bicarbonate of lime is destroyed by boiling, with the formation of insoluble carbonate of lime, which does not act on soap, it is said to produce *temporary hardness*, while sulphate of lime, which is not affected by boiling, produces permanent hardness.

Organic Matter. — Another impurity which is always present in water, but whose exact chemical character has not been fully determined, is organic matter. This is a collective term for a great many different substances derived from decomposing vegetable and animal matters.

Humic, ulmic, crenic, and apocrenic acids, are the names which have been given to harmless products which result from the decomposition of vegetable

matters, and which are probably always present in spring waters. The objectionable organic matters derived from animal decomposition rarely occur in the waters of springs.

Living Organisms. — In addition to the soluble and suspended impurities already mentioned, we find living organisms in water, animals and plants. These animals, when magnified by the microscope, are very frightful in their appearance and motions, but they are not really objectionable. The plants even exercise a purifying influence on the water. It is stated by a celebrated English author, that the providential spread of the American weed *Anacharis Alcinastrum*, has saved thousands of lives by the purifying influence which it has exerted on the water-courses in certain districts in England. These plants liberate oxygen which attacks poisonous dead organic matter and destroys it, thus ridding the water of its most dangerous impurities.

It occasionally happens, however, owing perhaps to some peculiarity of the season, that microscopic animals or plants multiply to such an unusual extent in the waters of lakes or rivers as to produce serious annoyance. This occurred some years ago in the Croton Lake. The subject was investigated by Dr. John Torrey, who reported the presence of myriads of animalcules, which by their death and decomposition communicated to the water a disagreeable taste and odor.

It may be considered as fully established that the ova of entozoa (the eggs or embryos of parasitic worms) gain, sometimes, entrance to the body by the water we drink. We have no reason to believe, however, that the animalculæ in the Croton, Ridgwood, and other city waters of the United States, are such embryos; or, in fact, that they are in any way objectionable.

In Iceland, however, it is stated that one sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia, or tapeworm of the dog. Young leeches, contained in drinking water, sometimes fix themselves on the pharynx. In a march of the French in Algiers, four hundred men were in the hospital at one time from this cause.

2. Well Water. — Ordinary open wells are supplied partly by springs and partly by surface drainage. The water usually contains the alkaline and alkaline earthy salts of spring water; the total quantity of mineral matter and the relative proportions of the various salts depending upon the nature of the soil. In the neighborhood of dwellings the proportion of chloride of sodium or common salt is generally increased by the drainage of house refuse, which also leads to the contamination of the water with the products of the decomposition of animal matters such as salts of ammonia, nitrites, and nitrates. In many cases, from the proximity of cesspools and privy vaults, the water becomes contaminated with filtered sewage, matters which, while they hardly affect the taste or smell of the water, have, nevertheless, the power to create the most deadly disturbances in the persons who use the waters.

In the neighborhood of graveyards the water of wells is often impregnated with animal matters from the recently filled graves. As long ago as 1808 it was decreed in France that no one should dig a well within one hundred metres of any cemetery.[1]

[1] See article by Jules Lefort in *American Chemist*, vol. ii., p. 448.

The water of driven wells does not differ in any respect from that of open wells in the same localities, except in cases where there is near the surface a bed of clay or "hard pan," impervious to water. When such a stratum is penetrated by the tube, and the water is drawn from beneath it, the well is somewhat protected from surface drainage.

Artesian wells are in some localities of the greatest economic and sanitary importance, yielding water where it could not otherwise be obtained at all, or pure water, when the shallow surface wells are too impure for domestic use. The former case is illustrated in the Lybian desert, where there are no rivers or springs, and upon which rain never falls: the latter case in the city of London, where the surface wells are contaminated by sewage, while the artesian wells, four or five hundred feet deep, bring up from the chalk beds below a very pure water.

One of the most celebrated fresh water artesian wells is that at Grenelle, a suburb of Paris. It is 1798 feet deep, cost $72,500, and supplies nearly 900,000 gallons daily. The water is received in a reservoir near the Pantheon, and distributed to the adjacent parts of the city.

Deep artesian wells, though free from organic impurities, often contain so much mineral matter as to give them medicinal qualities. This is the case with Dupont's artesian well in Kentucky.

3. Pond, Lake, and River Waters. — Pond, lake, and river waters, although containing the same mineral impurities, are generally purer than spring water, for the reason that while those bodies of water receive the waters of springs, they also receive a considerable quantity of water which has simply run *over* the surface of the earth. When a shower comes up, a portion of the water goes through the soil and issues as a spring; but a large portion of it runs over the soil, and goes into the lakes and rivers without taking with it much mineral matter. For this reason the waters of lakes and ponds are much purer than those of the springs in the same locality. One of the purest waters known is the water of the River Loka in Sweden, which contains only one twentieth of a grain of impurities in a gallon. Rivers are more likely to be charged with *suspended impurities*, for the reason that their waters, which have not been filtered through the soil, carry with them a certain quantity of mud and organic matter. That is what we see in Potomac water; it has had no opportunity to settle, and has not been filtered out. When water flows into lakes and the sediment subsides, it becomes clear. But in streams where the water runs rapidly, it has no opportunity to deposit its sediment, and it often appears very turbid. The water of the Mississippi contains forty grains of mud per gallon; and it is estimated that this river carries 400,000,000 tons of sediment per annum into the Gulf of Mexico. The Ganges is said to carry down 6,368,000,000 cubic feet annually. This transportation of mud in suspension has produced large deposits at the mouths of these rivers. All of the State of Louisiana, and considerable portions of other States which border upon the lower Mississippi, have been formed by the deposition of these sediments brought from higher levels. This mud is rich in plant food, and the land which it produces is very fertile. The Mohawk flats are famous for their

fertility; and the annual overflow of the Nile is the chief reliance of the poor Egyptians who cultivate the fields enriched by its sediments.

Rivers flowing through populous districts and receiving the drainage of the towns on their banks, often become contaminated with sewage to such a degree as to make them positively offensive, and dangerous to those who drink their water.

The waters of ponds are more largely supplied by springs; they are generally clearer than those of rivers, as the suspended impurities subside. They often exhibit more or less color, due to peaty matters held in solution. This is specially the case in the Dismal Swamp, and in new reservoirs; such matters are entirely harmless.

II. — EFFECT OF THE IMPURITIES CONTAINED IN WATER.

1. Mineral Impurities. — The quality of the impurities is more important than the quantity. It is found that five or six grains of lime or magnesia render water unfit for the cooking of leguminous vegetables. On the other hand, it is a great advantage in making tea or coffee to use water of about five degrees of hardness; that is, containing about five grains of carbonate of lime or its equivalent in the gallon. A person of very nice taste can tell the difference in tea or coffee made with water in which the difference is not more than two or three grains of lime or magnesia to the gallon. It is on this account that certain wells have a great reputation as "tea wells." In olden times there were two or three such wells in New York, and a boy was kept by the corporation to pump water for the benefit of the natives. The fine flavor of the tea made with such water is due to the fact that the five or six grains of carbonate of lime prevent the water from dissolving the astringent matter contained in the tea, without interfering with the extraction of the theine and the other desirable constituents of the leaf.

Magnesia in large quantities is objectionable, as are also lime salts. They are liable to cause dyspepsia. It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in the water; at least the facts observed make this reference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed, and found to contain seventy-seven grains of lime and magnesia salts per gallon. On substituting for this a water containing only eighteen grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. In the limestone districts of England, Switzerland and central New York, this goitre has been traced over considerable areas. At Goruckpoor, in India, where the waters are quite calcareous, ten per cent. of the adults are afflicted with goitre, and many of the children are cretins. Even the cats and dogs are said to be afflicted with cretinism, which is a kind of idiotic insanity. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones

abound, goitre is not uncommon. Perhaps the idiotic behavior of those famous Kilkenny cats is attributable to the calcareous impurities of the water with which these unfortunate quadrupeds slaked their thirst.

With regard to the total quantity of impurities admissible in good drinking water, the sanitary congress which met at Brussels decided that water containing more than thirty-five grains of impurity in one gallon is not wholesome, and that there should not be much more than one grain of organic matter. Thirty-five grains is a large quantity for city water, though well waters frequently contain more.

More recent investigations have shown that moderate quantities of these compounds are actually desirable, at least this is claimed by some of the most distinguished authorities in England, where the subject of water supplies for cities has been most carefully studied. Dr. Letheby has carefully examined the connection between the quantities of lime and magnesia salts contained in the waters used in sixty-five English and Scotch cities and towns in connection with the rates of mortality. For convenience of comparison the waters are rated according to their hardness, represented in grains per gallon of carbonate of lime, or its equivalent in soap-destroying compounds.

Table showing hardness of the Water Supply and the Death Rate.

Hardness.	Number of Towns.	Average Death rate per 1,000.	Average Hardness.
Over 10°	25	21.9	16.
10° to 6°	17	24.9	8.
6° to 2°	15	26.3	3.8.
2° and under	8	28.5	1.3.

It would certainly appear from these figures, that waters containing earthy salts in considerable quantities are preferable to very soft waters. Even if this generalization of Dr. Letheby is not fully sustained, the old theory, which demanded the softest water possible, can hardly stand in opposition to these facts.

2. Organic Matter. — The organic matter of a purely vegetable origin, such as occurs to the extent of one, two, or three grains per gallon, in country springs and wells, or in ponds and rivers, even when it contributes a tint of yellow to the water, is entirely harmless and unobjectionable. The nitrates, nitrites, and ammonia salts found in wells in densely peopled towns are themselves harmless, but their presence proves the contamination of the water with the products of decomposition of animal refuse, and should always be viewed in the light of a warning of the presence of impending danger.

3. Animal Excreta. — The products of the decomposition of animal matter in water, is, however, by far the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances

are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character, are often caused by an irruption of sewage into wells, either from a break in the sewer or cesspool, or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich, thirty-one out of one hundred and twenty-one of the inmates were affected with typhoid fever. It was found upon investigation that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made.

At Pittsfield, Mass., the typhoid fever suddenly broke out in a large boarding-school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cesspool.

At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and thus actually murdering the unfortunate victims with sewer poison.

Dr. Stephen Smith, your distinguished president, describes an interesting case that came to his knowledge. He visited an old schoolmate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump-maker, they sent a man down to a neighboring spring to draw water, who finding that it was not easy to dip the water of the spring, from the shallowness o the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farm-yards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa after several days, typhoid fever in its worst form was ushered in. Of the entire family but two escaped an attack, and they did not use the water.

It is a common saying in villages and towns that "there was health in the old houses, while there is death in the new." This is owing to the fact that when villages were first settled, the houses were supplied with water from the springs on the hill-side, while, as the dwellings multiplied in number, these sources of supply proving insufficient or too distant, wells were sunk in the valley, which, of course, received the drainage of the locality. Hence diseases such as typhoid and typhus fevers, diphtheria, etc., which were unknown to the early settlers, ultimately become prevalent.

I might multiply illustrations without end, of cases in which diseases have been directly traced to impure water. I have here a little diagram which illustrates a case that occurred in the town of Charmouth, in England, a little village situated on the side hill, at the mouth of the Char. The houses are supplied from surface wells, sunk in the gravel and marl.

Typhoid fever broke out. My friend, from whom I obtained the facts, was a scientific man, and knowing that it was not safe to drink the water from these wells, so informed his friends, whom he directed to draw their supplies from the spring above the village. My friend had half a dozen children. Two or three of them were strong enough to manage the pump, and against his express order they drew the water from the well, and drank it. They got the disease as a consequence; but none of the children who could not use the pump, and none of the neighbors who drew water from the springs, were affected.

This city, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use, by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water, and the completion of the very perfect system of sewers.

Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells, and other impure water supplies.

At Exeter, England, in 1832, one thousand deaths occurred from cholera.

A purer supply of water was then introduced from a locality two miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only forty-four cases occurred, and in the cholera season of 1854, there was hardly a case.

In London, in 1854, the water supplied by the Southwark Company contained much sewage, while that supplied by the Lambeth Company was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water, the deaths amounted to one hundred and thirty in 10,000, while among those who drank the Lambeth water, they amounted to only thirty-seven in 10,000; 2,500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848–49, the case was the reverse. The deaths from the Lambeth amounted to one hundred and twenty-five, while those from the Southwark amounted to one hundred and eighteen in 10,000. At that time, the Lambeth company took their water from a point lower down the river.

Another very striking instance occurred in London. The famous Broad Street pump supplied water in one of the most fashionable localities of the West End. During the visitation of 1848–49, this pump killed five hundred persons in a single week, by disseminating cholera. The wealthy people of the West End went to Brompton, a fashionable summer resort, about five miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad Street pump for tea-water, and had brought the cholera with it. A curious case was that of an old spinster, who had moved to Hampstead, three miles from the pump, but who sent her maid daily, for a kettle of the highly-prized tea-water. She and her maid were the only persons who suffered from cholera at Hampstead.

A similar story might be told of an outbreak of cholera in a shanty village, west of Central Park, and another in a shanty village on the heights across the river. In both cases, it was clearly shown that the cholera germs were distributed among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the twelfth ward of Brooklyn, at the corner of Van Brunt Street, from which over fifty families obtained their water supply. In 1866 cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump handle.

From these facts, it is seen that water aids in disseminating two of the most fatal diseases which affect the human race: the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866, there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe, that at least three fourths of these deaths might have been prevented had proper attention been paid to the purity of the water supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage.

III. THE SPONTANEOUS PURIFICATION OF RIVER WATER.

While the animal matters which find their way into wells from cesspools and privies are capable of producing the fatal results to which I have called your attention, it is now well settled that such matters are speedily oxydized and destroyed, and thus rendered harmless, when they flow into running streams, by the oxygen held in solution in the water. Dr. Alfred Taylor stated before the Parliamentary Commission, that "organic matter in water is only offensive while in process of decay; when this operation is completed it ceases to be offensive."

Sewage which would poison an ordinary well, becomes harmless in the running stream, and while the well is always open to suspicion, the river, though it drain populous districts, will, nevertheless, supply wholesome water. Having recently had occasion to study this question in connection with the project for supplying the city of Albany from the Hudson River, I have collected some facts and opinions which I will present to you, as embodying the views of the most recent investigators of this subject.

The Water of the Hudson River. — The suspended impurities which rendered the water turbid, being temporary in character, were allowed to subside ; the clear water was then found to contain the following substances in one United States gallon, of two hundred and thirty-one cubic inches. An analysis of the Croton water is presented at the same time, for comparison.

Analysis of the Water.

	Hudson River.	Croton River.
Chloride of Sodium	0.361 grains.	0.402 grains.
Chloride of Magnesium	0. 57 grains.	–
Sulphate of Potassa	0.076 grains.	0.179 grains.
Sulphate of Soda	–	0.260 grains.
Sulphate of Lime	0.980 grains.	0.158 grains.
Bicarbonate of Lime ($CaO,HO,2CO_2$)	4.165 grains.	2.670 grains.
Bicarbonate of Magnesia ($MgO,HO,2CO^2$)	1.397 grains.	1.913 grains.
Silica	0.408 grains.	0.621 grains.
Alumina and Oxide of Iron	0.070 grains.	a trace.
Organic and Volatile Matter	0.699 grains.	0.670 grains.
Total	8.313 grains.	6.873 grains.
Hardness	$3^\circ.35$	$2^\circ.51$

The water of the Hudson has been, and is now, freely used by boatmen and on the steamboats, and by all who are so situated as to make it the most convenient source of supply, and no complaints are known to have been made with regard to its quality, nor has any one suspected it of being in the least unwholesome.

This experience is, however, so limited that it was necessary to seek in other localities for analogous conditions and to satisfy ourselves by comparison, with regard to the probable quality of the Hudson River water. There is no locality in the world to which we could turn with a greater certainty of finding a full array of facts and opinions than have been accumulated in England with regard to the Thames, which supplies more than one half of the water used in London. I therefore instituted a comparison between the two streams in regard to the sources of defilement, volume of water, and natural facilities for aeration and spontaneous purification.

Extent and Population of the Drainage Area of the Thames. — The area of the Thames watershed, above the point at which the water companies take their supply, is 3,676 square miles, or 2,352,640 acres, while the population is about one million.

There are three large cities, Oxford, Aylsbury, and Reading, each with a population of over 25,000. The cities next in size are Windsor, Guildford, and St. Albans, containing from 7,600 to 9,500 inhabitants. Besides these there are thirty other towns containing from 2,000 to 7,000 inhabitants each. The average for the entire area is one person to about two and one third acres, or two hundred and seventy-two to each square mile.

The rain-fall in this area averages 27.2 inches, and it is estimated that

one third of this quantity flows down the Thames at Kingston. The average flow at Kingston, for five years, was 1,350,000,000 gallons daily, equivalent to nine inches of rainfall. In very dry seasons, the flow is reduced to 350,000,000 gallons.

Extent and Population of the Drainage Area of the Hudson River. — The Hudson River at Albany, including the Mohawk, drains an area of about 7,000 square miles, or 4,500,000 acres, while the population is about 400,000.

On the Hudson there are two large cities, Troy and West Troy, containing 46,421 and 22,616 inhabitants, respectively; and one on the Mohawk, Utica, with a population of 28,798. There are fourteen other cities and towns on the two rivers, with from 2,000 to 15,000 inhabitants each. Still the greater part of the population is scattered in villages, hamlets, and isolated farm-houses.

Very few of these towns are provided with sewers, consequently very little of the unoxydized organic matter of sewage finds its way into the streams. In this respect differing from the English towns on the Thames, where, until recently, the sewage was poured directly into the river.

The average for the entire area is about eleven acres to each inhabitant, or fifty-seven persons to each square mile. The average volume of the Hudson at Albany, was estimated by Mr. Sweet to be 618,111 cubic feet per minute, equal to an average daily flow of 6,677,000,000 gallons. The minimum being 1,829,000,000 in July, and the maximum 12,330,000,000 in March.

Comparison of the Hudson with the Thames.

	Hudson.	Thames.
Population of the watershed . . .	400,000	1,000,000
Population per square mile	57	272
Average daily flow	6,677,000,000 gallons.	1,350,000,000 gallons.
Minimum daily flow	1,829,000,000 gallons.	350,000,000 gallons.

It thus appears that the population of the Thames' area is two and one half times greater than that of the Hudson, and five times more dense, while the flow of the Thames is only about one fifth that of the Hudson. Comparing the population with the flow of the rivers, we find that, in the case of the Thames, it is twelve and one half times greater than in the case of the Hudson.

Healthfulness of the Thames' Water. — There have always been alarmists who have excited the fears of the people of London with regard to the condition of the water supply, and there are still those who believe that it is not safe to drink it. From time to time Parliament has caused committees to examine into its condition, and a royal commission has had the matter under consideration for several years. A few quotations from the reports of these bodies and from other sources will serve to show the opinions of those who are most entitled to respect.

Opinion of the Committee of the House of Commons and the Chemical Commission. — A special committee of the House of Commons considered the

report of the royal commission of 1850 on the water supply, and employed three of the most distinguished chemists of England to aid them in their investigation. Professor Graham, Master of the mint; Professor W. Allen Miller, and Professor Hoffman. The final verdict of the committee is embodied in the following sentence: "The Thames' water is perfectly wholesome, palatable, and agreeable; uniform, plentiful, and safe in use."

The chemical commission, composed of the chemists above mentioned, reported as follows: —

"As the main drain of a large and populous district, the Thames becomes, at all seasons, polluted by the sewage of several considerable towns, and by the surface drainage of manured and ploughed land; at the same time, we doubt whether the existence of organic contamination from town drainage is at present perceptible in the Thames above the reach of the tidal flow (*i. e.*, above London), or amounts to a sensible evil. The indefinite dilution of such matters in the vast volume of the well aërated stream is likely to lead to their destruction by oxydation, and to cause their disappearance. The river may reasonably be supposed to possess, in its self-purifying power, the means of recovery from an amount of contaminating injury equal to what it is at present exposed to in its higher section (*i. e.*, above London.)"

In 1867 another committee of the House of Commons inquired into the water question. After listening to the testimony of a number of the most competent experts they declared that "They were satisfied with both the quantity and quality of the water supplied by the River Thames." The water of the Lea they found "naturally not only wholesome, but comparing favorably with that supplied to other places."

While these extracts represent the general verdict in favor of the Thames water, there were still, and there are even now, a few who dissent from this opinion. The most prominent of these is Dr. Frankland, professor of chemistry at the Royal Institution.

Dr. H. Letheby, the medical officer of health for the city of London, thus criticizes his opinion: —

"In reply to your letter of the 5th instant, I have to state that I cannot agree with Dr. Frankland that the water of the Thames, after receiving defecated sewage water, is unfit for domestic use; for, after a large practical acquaintance with the subject as it is observed in the principal streams and rivers of England, I have arrived at a very decided conclusion that sewage when it is mixed with twenty times its volume of running water and has flowed a distance of ten or twelve miles, is absolutely destroyed; the agents of destruction being infusorial animals, aquatic plants and fish, and chemical oxydation."

Dr. Frankland seems to contradict himself, for in an article in the "Quarterly Journal of Science" of 1867, he says: —

"The population in the basin of the Thames above where water is taken is 1,000,000, the drainage of some 600,000 of whom is poured into the river; the sewage is so thoroughly oxydized that no trace of it can be detected in an unoxidized state. The average flow of the river at the point where the companies take their supply is 800,000,000 gallons daily. The sewage contained would be $\frac{2250}{100000}$."

Report of the Royal Commission. — In 1869 the royal commission on the water supply of the metropolis made their last report, which was published in a folio volume of 128 pages, and was accompanied by a volume of minutes of evidence of 488 folio pages, and an appendix of 144 pages with numerous maps, etc. In this report they say: —

"But though for these reasons we believe that the organic contamination of the Thames is much less than is commonly imagined, still it would be sufficient to do great mischief, were it not for a most beneficial provision of nature for effecting spontaneously the purification of the streams. Some of the noxious matter is removed by fish and other animal life, and a further quantity is absorbed by the growth of aquatic vegetation; but, in addition to these abstractions, important changes are effected by chemical action. The organic compounds, dissolved in water, appear to be of very unstable constitution and to be very easily decomposed, the great agent in this decomposition being oxygen, and the process being considerably hastened by the motion of the water. Now, as such waters always contain much air dissolved in them, the decomposing agent is ready at hand to exert its influence the moment the matter is received into the water; in addition to which the motion causes a further action by the exposure to the atmosphere, and when (as in the Thames) the water falls frequently over weirs, passes through locks, etc., causing further agitation and aeration, the process must go on more speedily and more effectually. The effect of the action of oxygen on these organic matters, when complete, is to break them up, to destroy all their peculiar organic constitution, and to re-arrange their elements into permanent inorganic forms, innocuous and free from any deleterious quality. This purifying process is not a mere theoretical speculation. We have abundant practical evidence of its real action in the Thames and other rivers."

In order to present more in detail the opinions of the scientific advisers to the commission, I will present a few extracts from the testimony.

Extracts from the Testimony before the Commission.

Testimony of Sir Benjamin Brodie, Professor of Chemistry in the University of Oxford. — "Oxidization is constantly going on in the soil and in the river; and, therefore, there must be some point at which the perfect destruction or oxidation of its animal matter must take place. What I think is much more important still is another point, namely, the great dilution of the material; and I should rely upon the dilution quite as much, and more, than upon the destruction of the injurious matter; supposing the sewerage of a large town, as Oxford, pouring into the river, there are numerous feeders and tributary streams to the river, which effectively dilute the sewerage. The sewerage is gradually getting less and less, and, therefore, its noxious character diminishes, and ultimately disappears."

Testimony of Dr. Odling, Professor of Chemistry at the Royal Institute and at St. Bartholomew's Hospital. — Q. "Has your attention been directed to the important principles of the self-purifying processes which are going on in the rivers running at a given velocity?" A. "Yes, it has." Q.

"You will understand my question is not referring to sluggish waters, but to the rivers where the body of water would become exposed to the action of the atmosphere as it passes along?" A. "You may see in many rivers, even sluggish rivers, having sewerage discharged into them, that for a mile or two the appearance of the river is affected by the sewerage, but beyond a certain distance there is no recognizable effect at all, the weeds are perfectly clear and perfectly healthy."

Testimony of Dr. Miller, Professor of Chemistry in King's College, London. — Q. "Are you of the opinion that water once contaminated with sewerage can never be considered a safe water afterwards?" A. "I think experience is quite against that, I think it is safe, evidence shows that it is safe in the majority of instances. There may be cases in which danger is produced." Q. "Have you made any experiments upon the power of water, in a given course, to oxidize organic matter?" A. "I ascertained a remarkable result in 1859 upon the river: I took specimens of the water at Kingston, at Hammersmith, at Somerset House, at Greenwich, at Woolwich, and at Erith on the same day, and I examined the quantity of oxygen which the water contained at all those different points. I found the quantity of oxygen at Kingston was the normal or ordinary proportion; at Somerset House it was much diminished; at Greenwich the whole of the oxygen had disappeared; at Woolwich it was in much the same condition; at Erith it was very much improved, showing that this diminution of oxygen had been produced by the action of the water, contaminated with the sewerage of the London district, and that as it passed lower down the oxygen was again absorbed from the air. And again it became diluted with a large volume of water from below, from other sources, the Lea, the Ravensbourne, and other tributaries, and in this manner the water had again become oxidized. I look upon this as a direct proof of the effect of oxygen in destroying those organic contaminations which are thrown into the river."

Testimony of Dr. Parkes, Professor of Military Hygiene of the Army Military School at Netley. — Q. "Have you observed in a case where sewerage has been discharged into a river, that, after running three or four miles, the effect of the sewerage has been destroyed?" A. "Yes, we have that, in the case of the Southampton water supply. Some sewerage passes into the Itchen River, but it is quite destroyed by the time the water is distributed in Southampton, at least there is no detectable quantity." Q. "What is the distance?" A. "The distance is six or eight miles. I could not undertake to state the distance in which water would purify itself in that way, but there is no doubt that it does purify itself, although in what distance, or in what time, or under what precise circumstances, I could not say."

Testimony of Mr. Leach, Engineer to the Thames Conservancy Board. — Q. "How soon, in your observation, is the effect of sewerage destroyed by its flow and admixture with the waters?" A. "At Windsor it is discharged into a most unfavorable point in the river, where there is little or no stream at ordinary times. The matter which is passed out of the drain, floats about in the river there to a very great and very disgusting extent. Two miles, or even a mile below, I could see no traces whatever of the sewerage."

Testimony of Mr. Hawksley, Vice-President of the Institute of Civil Engineers. — "The great complaint of London water is not the quality of the water itself so much as the polluted district through which it passes. That, I think, there is the greatest possible amount of misconception upon. There is a great deal of prejudice, not unnatural at all, but still amounting to prejudice upon that question. I believe, in fact I know, that the water of the Thames at Hampton is a very excellent water, very pure, very free from organic matter, and that what little organic matter there is, is of a very innocuous character."

Q. "What quantity of water, as compared with the volume of sewerage, is necessary for the purpose of breaking up into its original elements the sewerage which has been discharged into it?" A. "Generally about twenty to one; if the water flows rapidly and is very much disturbed so as to be continually receiving fresh oxygen, a smaller quantity, even twelve to one, will effect the process; if it proceeds very tardily it may take a little more, but usually twenty to one is perfectly abundant."

Q. "You remember, do you not, the original condition of the river at Leicester after receiving all the sewage of the town into it?" A. "Yes, perfectly well; at Leicester the water was as black as this ink; I do not mean to say that it was absolutely so thick, but looking at it in a mass, it was as black as ink; nothing would live in it, and the smell was abominable; but by the time it got to Loughborough, twelve miles below, it was entirely restored to its pristine condition; you could stand on the bridge there and see the fish swimming among the beautiful reedy and other plants growing in the water just as in the purest stream; you could see every pebble at the bottom; that is an instance of the effect of oxidation."

Q. "The water has symptoms of returning purity, has it not, within four miles of Leicester?" A. "Yes, but not to the same extent as at Loughborough; the water was perceptibly impure, at the driest period of the year, down as far as Barrow; it could be just perceived there, but at Loughborough it was perfectly restored."

"There is no such thing as a particle of fæcal matter put into the Thames at Oxford, finding its way down to Hampton Court. It is all burnt up, in fact, by the combustion set up by the oxygen."

THE CHOLERA QUESTION. — It having been established with some considerable degree of probability, that the wells in certain parts of London had aided in disseminating the cholera poison during the successive visitations of that disease to the metropolis, an opinion had gained credence that the water of the Thames had contributed in no small measure to swell the awful list of victims who died from that disease, especially the water supplied by the East London water-works. Considerable testimony was therefore taken upon this point, the most important of which I will quote.

Testimony of Dr. Robert Argus Smith, Government Inspector of Alkali Works. — "If the germs pass into the rivers we do not know how far they may be carried. On the other hand we do not know that they ever can be carried in pure water; the dissolved oxygen may destroy them, as it unquestionably does putrescent matters. A positive proof of their transmission, in

otherwise pure water is wanting. One might ask if a cholera germ in the water at Oxford would produce disease in London; and one might answer by asking if one cholera germ passing into the air at Woolwich would produce disease in Pimlico. This we do not know, but it seems probable that disease cannot be carried far by pure air, nor by water with much oxygen in it, which is equal to pure air. We are informed that the atmosphere is full of germs, but the evidence seems to be that it requires an unusual excess to attack us successfully; it seems to be a question of quantity."

Testimony of Dr. Letheby, Medical Officer of Health to the Corporation of London. — Q. "Taking the case of the cholera disease and the discharges from the human body being mixed up with the sewage, do you consider that any germs of that disease would be carried down in water?" A. "At the present moment, we do not know what the germs of disease are; if the germs of the disease be decomposing matter, then I do not think that they would exist in the water; but if the germs of the disease be living matter, then it is possible that they may exist in the water; but as nobody, as far as I am informed, can tell us what the germs of cholera are, it would be premature for me or anybody to theorize as to the probability or the possibility of their existing in the water."

Q. "You are aware that it has been alleged that the main cause of the cholera, in the east end of London, was due to the water supply; do you entertain that opinion?" A. "No, I entertain the opposite opinion; it was a matter of duty with me to investigate the whole of the circumstances connected with the East London supply; in the first place it was supplied to the hospital to which I am attached; in the next place it was supplied to the eastern division of the city, where, as officer of health, it was my duty to look well into the matter, and in the third place I had a general interest in it scientifically, apart from any official connection with the subject, and I was very desirous to ascertain whether or not the water had been in any way concerned in the propagation of the disease; I therefore investigated it very fully."

Q. "Do you think the present supply of water to the London people is wholesome water?" A. "I do, a thoroughly wholesome water."

In his report on the sanitary condition of the city of London for the years 1866–67, Dr. Letheby is much more explicit in his discussion of the cholera epidemic of 1866. He says, on page 26, *et seq.*: —

"But difficult as the problem is, to determine the exact value of the several circumstances which influence the severity of the disease, and especially those which give to it its marked local intensities, enough has been ascertained to indicate its general habits, and to show that it fixes itself at low levels in proximity to tidal rivers, among dense populations, that are living in ill-constructed houses, that are filthy, badly ventilated, badly drained, and generally defective of sanitary provisions; and the inference is, that the actual agent of cholera, be it what it may, can only find congenial conditions for its full development in damp and impure air."

"The theory of Pettenkofer is, that the essential conditions for the active manifestations of the disease are a porous soil, charged with excrementitious

matter, and having a certain degree of hydration, as happens when the subsoil water is just drawn off or is slowly retiring. All these conditions were singularly coincident with the localization of the disease in the eastern districts of London; for the soil is gravelly, and therefore very porous to air and water, and it is largely charged with excrementitious matters derived from the local tide-locked sewers. It is also remarkable that for some months before the outbreak of the disease, the subsoil water had been gradually sinking in consequence of the drainage operations that were necessary for the construction of the main low-level sewer, and its branch to the Isle of Dogs. Now, according to Pettenkofer, it is exactly under these circumstances that a district is most liable to choleraic infection."

"Another theory which has been advanced to account for the local character of the outbreak is, that the water distributed to the infected districts was charged with choleraic matter; but, looking at all the facts of the case, it is clearly evident that while none of them are discordant with Pettenkofer's theory, a large number are in open and direct antagonism to the water hypothesis. In point of fact it is necessary for the acceptance of such a speculation, not only that some clear proof should be given of the actual pollution of the water with choleraic matter, but also that the time of the outbreak throughout the infected district was coincident with the distribution of such water, and that it did not notably fail to produce the disease wherever it was sent. It is likewise necessary to show that the disease was strictly confined to the area of such distribution, and that the use of other water was not accompanied with like severe results."

"The alleged pollution of the water rests upon a series of assumptions, many of which are in the highest degree improbable."

"Apart, however, from the improbabilities of these assumptions, it is a fact that the water which is said to have been thus polluted did not produce its effects in the several districts to which it was distributed in anything like uniformity of time or force. Suppose, by way of illustration, that alcohol or arsenic had become mixed with the water, and that on a certain day it was distributed to the public; we should expect to find that the action of the poison was not only manifested at the same time over the whole district of supply, but that it was confined to that district. Not so, however, with the water in question, for although it is not alleged to have been more than once polluted, yet the first effects in the several districts occurred at long intervals; and there were many places to which it was distributed, where there was no sign of the disease; while others, which did not receive the water, were seriously affected."

"The dates of the outbreak of the disease in the districts supplied with the East London water were as follows: Bromley, June 27th; Poplar and Bethnal Green, June 30th; Shoreditch and Mile End, July 7th; Whitechapel, Stepney, and St. George's-in-the-East, July 14th; and the East London Union, July 28th. A month, therefore, elapsed between the first outbreak of the disease in the several districts. It is, moreover, remarkable that, while it was so violent in many of the districts of supply, it was absolutely powerless in others. The death rate, for example, of Bethnal Green was

sixty-three per ten thousand of the population ; Whitechapel, seventy-eight ; Poplar, eighty-five ; and St. George's-in-the-East, ninety-three ; whereas the districts of Stamford Hill, Upper Clapton, Walthamstow, Woodford, Wanstead, Leytonstone, Buckhurst Hill, North Woolwich, and Silvertown, were absolutely untouched by the disease, notwithstanding that they received the same water, and at the same time."

"More remarkable still, there were places in the very heart of the cholera field, and others close adjoining it, where the residents received the same suspected water, and used it freely without suffering in the least degree. In the Limehouse School, around which the cholera was frightfully fatal, there were four hundred children who drank the same water as their neighbors, and yet there was not even a case of diarrhœa among them. In the London hospital, which is also in the heart of the cholera field, for it is surrounded by the districts of Whitechapel, Bethnal Green, Mile End, Old Town, and St. George's-in-the-East, there was an average resident population of four hundred and sixty-three persons, and, although they drank freely of the unfiltered East London water, yet there was not a case of illness among them."

"Again, in the eastern division of the city of London, which adjoins the cholera field, the suspected water was supplied to one hundred and sixty-one houses, with a population of about one thousand seven hundred and thirty-two persons, but except in one of these houses (20 Somerset Street), which is on the boundary of Whitechapel, there was not a single death from cholera, and to verify this, I have obtained the addresses of all the persons who died in the cholera ward in Bishopsgate Street. But, besides this, the disease was singularly fatal in places where the suspected water was never used. In Crown Court, Blue Anchor Yard, Whitechapel, where the water supply is from the New River, the mortality was at the rate of two hundred and eighty-four per ten thousand. In Boar's Head Yard, of the same district, which is also supplied by the New River, the death rate was one hundred and ninety-three per ten thousand ; and indeed there are eighteen courts in Whitechapel, where none of the East London water was used, and yet, out of an aggregate population of four thousand three hundred and fifty-one persons, there were thirty deaths from cholera, the mortality being at the rate of sixty-nine per ten thousand ; that of the whole district being but seventy-seven."

"So that, on carefully examining the facts in their relation to the water theory, we find : —

1. "That there is no proof whatever of choleraic pollution of the water."

2. "That there was no coincidence of time in the appearance of the disease in the several districts supplied with the suspected water."

3. "That numerous districts receiving the same water, but situated at high level, or placed beyond the cholera field, were entirely exempt from the disease."

4. "That even in the very heart of the cholera field, there were places receiving and using the suspected water with impunity."

5. "That other places not supplied with the water, but situated within the infected area, suffered equally with the neighborhood."

"I am far from wishing it to be thought that choleraic matter diffused through water will not produce disease. There is abundant evidence to show that it is often a prolific source of it; but I am anxious, in dealing with a question of so much public importance as the origin of the late epidemic, that none of the facts should be perverted, and that no hasty or ingenious hypothesis, without solid foundation, should take possession of the public mind. In the conduct of inquiries like this, there should be a calm, a full, and a candid examination of the facts; we should endeavor to study the phenomena in a philosophical spirit, and apply to them the tests of sound induction; we should strive also to deduce from them such laws as will not only expose the nature of the malady, but will, at the same time, enable us to treat it successfully. Rash opinions, boldly asserted and tenaciously held, though they may force themselves on public attention, rarely lead to useful results; and while they have their hold on the popular mind they seriously hinder the progress of real knowledge."

These extracts are sufficient to indicate the opinions of the most eminent medical officers, chemists, and engineers who have considered the fitness of the waters of the Thames, for supplying the people of London with wholesome water.

The verdict of the commissioners, after carefully and conscientiously weighing all the testimony presented, is as follows: —

"The only point raised against the Thames water on the ground of organic contamination is of less positive character; it is said that water which has once been contaminated with sewage, may still contain undecomposed organic matter, which, though inappreciable by the most delicate chemical tests, may still exercise prejudicial effects on the human system."

"The strongest form of this objection has reference to some opinions now prevalent, that certain forms of disease, such as cholera and typhoid fever, are propagated by germs contained in excremental matter; and it is conceived possible that when matter of this kind once gets into streams, these germs may escape destruction and long preserve their dangerous character. It is said that no process is known by which such noxious material can be removed from water, and, therefore, it is argued, that water which has at any time been contaminated by sewage is henceforth unsuitable for domestic use. These opinions have been advanced by many eminent men of science; they are worthy of respectful attention, and ought to operate as a constant stimulus to the most searching examination of the state of the water; to the improvement of the modes and means of scientific analysis; and to the diligent collection of medical data as to the effect of the waters upon the public health. But we cannot admit them as sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water supply; we are of opinion that there is no evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome."

This report was made in 1869, and has been before the British public in an accessible form, in all its details, nearly five years, and its conclusions ave been generally accepted. The most recent opinion I have seen in print

is contained in a voluntary communication made by Dr. Alfred S. Taylor, the distinguished writer on chemistry, toxicology, and medical jurisprudence, to the secretary of the West Middlesex Water Company, under date of March 7, 1872. He says: "Having during the last twenty-one years made analyses of the water supplied to my house by the West Middlesex Company, and compared it with numerous waters derived from rivers, springs and lakes in England and Scotland, I can confirm Dr. Whitmore's general conclusion that the water is good in quality and perfectly wholesome. This opinion is not based merely on chemical analysis, but on twenty-one years' experience derived from its use for all domestic purposes."

CONCLUSION. — I have selected as our chief basis of comparison the water of the Thames, not only because it had been more carefully studied than any other source of city supply, but because it may be considered an extreme case. Notwithstanding the fact that one half the supply of London, a city of considerably more than three millions of inhabitants, is supplied from it, while the river Lea furnishes nearly all the rest, London was said by Dr. Edwin Lankaster, coroner of Middlesex, to be the *healthiest city in the United Kingdom.* Had I not already presented a much more voluminous paper than I intended, I should refer with some detail to the water supplies of several large continental cities, which are derived from large rivers flowing through much more populous regions, than that from which the Hudson issues, on the banks of many of which are cities much larger than any on this river. Tours is supplied from the Cher; Lyons from the Rhone; Toulouse from the Garonne; Angers and Nantes from the Loire; Paris from the Seine, the Canal d'Ourcq, and the Marne; Berlin from the Spree; Hamburg and Altona from the Elbe. The last named city, which is a suburb of Hamburg, takes its supply from a point eight miles below, when the water has received the drainage of two hundred and thirty thousand people. Most of the above mentioned rivers are among the largest streams in France and Germany, and flow through extensive and densely inhabited districts. Yet we have no reason to believe that there is any *permanent* defilement of the waters.

That there is generally no fear on the part of engineers, and those having charge of water supplies in American cities, is fully shown by the fact that many of our largest cities take water from rivers. Hartford is supplied from the Connecticut; Jersey City and Trenton from the Passaic; Philadelphia from the Delaware and Schuylkill; Washington from the Potomac; Cincinnati and Louisville from the Ohio; and St. Louis, New Orleans, and many other cities from the Mississippi.

IV. THE POLLUTION OF STREAMS BY THE REFUSE FROM FACTORIES.

It is often suggested that the waters of our rivers are liable to become polluted to a dangerous degree by refuse chemicals from paper factories, woolen mills, print works, and chemical works. While this may undoubtedly be true in some densely populated portions of England, where the factories are numerous and the streams very small, I do not think that for

years to come this source of pollution need be feared in this country. Our rivers are too large and our factories too much scattered; and the importance of turning all waste products to account is made imperatively necessary by the sharp competition which prevails among manufacturers. This latter point is well illustrated by our gas companies, who now derive an important revenue from the sale of their coal tar and ammonia water, offensive products which they formerly allowed to run to waste. The waste products of our most important industries are entirely harmless when diluted with large volumes of water. They consist chiefly of sulphuric and hydrochloric acids, lime, potash, soda, iron and alumina salts, chloride of lime, exhausted dye woods, and soap suds used in scouring wool.

The more powerful, form, when mingled, harmless salts, carbonates, sulphates, and chlorides, which are normal constituents of all river waters. The action of many of these products, if appreciable at all, will be to purify the waters, by oxidizing or precipitating the matters derived from sewage. Salts of iron and alumina are especially efficacious in purifying waters. Alum is often used in the West for clarifying the muddy waters of the streams; a pinch being added to a barrel of the water, which on standing a few hours becomes clear and limpid.

The possibility of objectionable pollution will depend in each case upon the ratio of the refuse matters to the quantity of water in the stream.

Dr. Edward Smith in his "Manual for Medical Officers of Health" states that the contamination of streams by the refuse of factories prevails exceedingly in Yorkshire and Lancashire. The waters of river Irwell, a small stream, present the following differences in composition at their source and below Manchester.

The Irwell.— Grains of Impurities in One Imperial Gallon.

	At Source.	Below Manchester.
Organic Carbon	0.1009	0.8211
Organic Nitrogen	0.0175	0.2324
Total Nitrogen	0.0343	1.1536
Chlorine	0.8050	6.7410
Hardness	2.6040	16.0440
Total Solids	5.4600	39.0600

The examination by the Rivers' Pollution Commission of fifteen samples of waters contaminated by the cotton and woolen mills in Yorkshire, showed the following quantities in one Imperial gallon, which were thrown into the waters of the rivers:—

Grains of Impurities thrown into each Imperial Gallon.

Organic Carbon	45.3481
Organic Nitrogen	7.2198
Nitrogen as Nitrates and Nitrites	0.0287
Ammonia	8.1529
Total combined Nitrogen	14.0105

Chlorine	15.3580
Arsenic (computed as metal)	0.0077
Mineral Matters [1]	332.3880
Total Solids [1]	235.9000

The commission gave a page in their report of 1871, showing in facsimile a letter written with the water of the river Calder at Wakefield, which equals in depth of color that from a watered ink, and similar examples might have been made from the river water at Bradford."

A clearer idea can be obtained of the influence of factory refuse on river waters, by comparing the quantities of chemicals used with the quantities naturally contained in the streams.

The Croton water contains in one United States gallon of two hundred and thirty-one cubic inches the following *normal* impurities: —

Croton Water. — Grains in One U. S. Gallon.

Soda	0.326
Potassa	0.097
Lime	0.988
Magnesia	0.524
Chlorine	0.243
Sulphuric Acid (SO^3)	0.322
Silica	0.621
Carbonic Acid	2.604
Organic and Volatile Matter	0.670
Total	6.395

One hundred million gallons of this water are used daily in New York, in which are contained the following quantities of the above mentioned substances in pounds, and in tons of 2,000 pounds.

Impurities in 100,000,000 Gallons of Croton Water.

	Pounds.	Tons.
Soda	4,657	2.319
Potassa	1,385	0.692
Lime	14,114	7.038
Magnesia	7,485	3.742
Chlorine	3,471	1.735
Sulphuric Acid	4,600	2.300
Silica	8,858	4.429
Carbonic Acid	37,200	18.600
Organic and Volatile Matter	9,571	4.785
	91,341	45.640

As the average flow of the Croton River is 400,000,000 gallons daily, there are 365,428 pounds or nearly 183 tons of impurities carried to the ocean daily, by a stream which does not receive any refuse from factories. The

[1] These numbers are incredible, and can hardly be accepted as presented without further explanation. — C. F. C.

Thames at Kingston has an average flow of 1,250,000,000 gallons (Imperial) daily, and the water contains

Inorganic Impurities	19.	grains.
Organic and Volatile Impurities	1.68	grains.
Total per gallon	20.68	grains.

This is equivalent to 3,364,286 pounds or 1,682 tons of 2,000 pounds inorganic matter daily; of this two thirds, or 1,121 tons, are carbonate of lime and 271 tons are sulphate of lime.

At the Arnold Print Works at North Adams, Mass., on the South Branch of the Hoosick, the following quantities of the most common chemicals were used daily: lime, 1¼ barrel; soda ash, 200 pounds; sulphuric acid (H^2SO^4), 320 pounds. There were contained in the 43,200,000 gallons of water that flowed daily down the stream:—

	Pounds.	Tons.
Lime	10,793	5.396
Soda (NaO)	2,050	1.025
Sulphuric Acid (H^2SO^4)	1,715	0.857
Or as combined, —		
Carbonate of Lime	18,852	9.476
Carbonate of Magnesia	10,342	5.171
Sulphate of Lime	574	0.243

The Valley Bleachery, on the Woonasquatucket River at Providence, R. I., consumed daily: sulphuric acid, 17 pounds; soda ash, 3,000 pounds; bleaching powder, 1,500 pounds.

The following table gives the most complete exhibit of the character and quantities of chemicals, etc., consumed in a large factory; it shows the average daily consumption of materials of all kinds at the Atlantic De Laine works at Providence, R. I., for the ten months from January 1, 1870, to October 29, 1870. The quantity of wool washed amounted to one thousand nine hundred and twenty-six pounds per day. The flow of the stream was thirty-six million gallons in twenty-four hours.

Daily Consumption of Chemicals at the Atlantic De Laine Works.

Wool washed, 1,926 pounds.

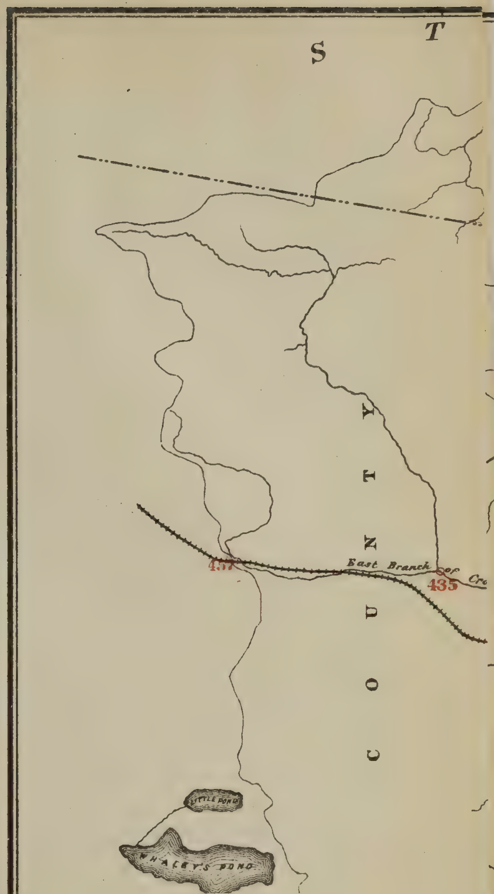
	Pounds consumed.	Grains per Gallon of Water in River.
Sumac	291.41	0.05665
Hypernic Wood	43.99	0.00855
Turmeric	73.33	0.01425
Logwood	144.05	0.02800
Fustic Wood	66.04	0.01283
Cudbear	63.91	0.01242
Madder	10.53	0.00204
Aniline Colors	1.17	0.00022
Sulphate of Iron	4.04	0.00078
Nitrate of Iron	88.56	0.01721
Muriate of Tin	29.09	0.00565
Stannate of Soda	43.68	0.00849
Sulphate of Copper	90.12	0.01751
Sulphate of Soda	43.75	0.00850
Alum	23.74	0.00461
Cream of Tartar	9.91	0.00192
Prussiate of Potash	14.13	0.00274
Bichromate of Potash	8.44	0.00164
Sulphuric Acid	136.39	0.02651
Soap	90.12	0.01751
Total	1209.75	0.23508

Supposing all the materials used to have been allowed to run into this little stream, less than one tenth the size of the Croton, the entire pollution would have amounted to less than one fourth grain per gallon. As a matter of fact a large portion of these substances were fixed upon the goods and sent to market, while one half the entire quantity consisted of dye woods, which are chiefly composed of insoluble cellulose (sawdust and chips). It is not probable that the refuse from this factory added 0.05 grain per gallon to the water of the stream.

During the war it was feared that some attempt might be made to poison the Croton supply of New York. The following figures show how difficult the task would have been. To poison the one hundred million gallons supplied to the city in a single day with strychnine, supposing each pint of water to have received the smallest fatal dose of this alkaloid, one sixteenth grain, would have required 7,285 pounds or three and a half tons of strychnine, a quantity not to be found in all the markets of the world. To procure such a quantity it would be necessary to order an extra supply of *nux vomica* beans from the East Indies, three or four years in advance, to secure their collection by the natives.

Supposing arsenic to have been selected, at the rate of two grains (the fatal dose) to the pint, one hundred and fourteen tons would have been required, with special means to secure its solution in the water.

I do not mean by these remarks to discourage reasonable efforts to protect the purity of our streams, but I would meet the absurd arguments of alarmists who frequently terrify our citizens with exaggerated accounts of imaginary dangers, now from the refuse of factories, now from the imaginary poisons of swamps.


S
T
COUNTY
East Branch of Cr
435
LITTLE POND
WHALEY'S POND


MAP
SHOWING
WATER SHED
OF THE
CROTON RIVER.
AREA OF WATER SHED
338 SQUARE MILES.
E. is the New Storage Reservoir
G. „ another do. do
now being constructed.
The numerals, in red, indicate the altitudes above tide-level.
The separate capital letters indicate available grounds for storage reservoirs.
The encircling hair-line marks the crest-boundary of the Croton Water shed.
STATE OF CONNECTICUT
STATE OF NEW YORK
DUTCHESS COUNTY
PUTNAM COUNTY
WESTCHESTER COUNTY
East Branch of Croton River
Middle Branch of Croton River
West Branch of Croton River
Muddy Br.
Horse Pond Brook
Pine Pond Brook
Wright's Brook
Black Pond Brook
Plum Brook
Quaker Brook
Titicus River
Cross River
Muscoot River
BREWSTERS STATION
DAM
CROTON LAKE
CROTON DAM
AQUEDUCT
Croton River
HARLEM RAIL ROAD
SCALE OF MILES.
Prepared and engraved for the American Public Health Association, to accompany the paper on Water Supplies of Cities by C. F. Chandler, M. D.

V. THE CROTON WATER.

Few cities are more fortunate in the quantity and quality of their water supply than are New York and Brooklyn. The Croton water is brought to the city of New York by an aqueduct forty-five miles long, which was completed in 1842, the water having been admitted on the 4th of July of that year. Where the water enters the aqueduct, a dam two hundred and thirty feet wide and forty-five feet high was erected in the Croton River, by which the Croton Lake was formed. This serves as a great reservoir or sedimentary basin.

The *Quantity of water supplied* to the citizens of New York is now one hundred and four million gallons daily, and as the population is now 1,040,000 the supply is one hundred gallons per capita. Mr. Jarvis, the engineer, guaged the river at its lowest period, and found its minimum flow to be thirty-two million gallons daily. In long continued dry weather a deficiency of water occurs, for the simple reason that there is not at present sufficient storage capacity in the reservoirs.

The following reservoirs are in the city: —

	Gallons.
Fifth Avenue reservoir	20,000,000
The old reservoir in the Central Park	38,000,000
The new reservoir in the Central Park	1,000,000,000
Total	1,058,000,000

Equivalent to ten days' supply.

Mr. Craven, formerly chief engineer of the Croton Department, carefully examined the region drained by the Croton and its branches, and found several points at which, by the erection of dams of moderate dimensions, enormous storage reservoirs could be formed. These reservoirs are indicated on the topographical map of the Croton water-shed, copied from the map published by Mr. Craven, which accompanies this paper, by the letters A, B, C, etc. The following table indicates the capacity and other important facts with regard to these reservoirs: —

Proposed Storage Reservoirs.

Reservoir.	Area.	Capacity.	Drainage Area.	Extreme Depth of Dam.	Extreme Length of Dam.	Length of Reservoir.	Distance from Croton Dam.	Elevation above Mean Tide.
	Acres.	*Gallons.*	*Sq. miles.*	*Feet.*	*Feet.*	*Feet.*	*Miles.*	*Feet.*
A	485.00	5,211,015,625	20.45	64	1,500	12,300	9.500	390
B	192.00	1,701,835,337	15.2000	55	1,700	6,000	12.750	500
C	730.00	6,589,101,562	13.7100	43	1,700	16,600	14.300	550
D	1008.00	9,033,632,812	41.9500	48	770	21,000	20.250	500
E	363.00	3,369,206,857	20.3700	64	700	7,500	23.750	600
F	600.75	6,120,335,937	12.5100	20.90	1,560	10,600	15.500	560
G	452.19	4,861,035,156	20.9045	73	541	12,200	18.700	375
H	384.67	2,490,062,500	75.4574	40	545	14,748	19.390	375
I	449.00	4,205,820,654	70.5230	62	331	12,745	20.447	415
J	191.38	2,314,074,703	11.9171	69	1,311	11,616	28.710	500
K	512.74	5,671,449,219	78.9000	72	904	14,809	15.215	275
L	262.75	2,328,217,733	26.8600	74	757	13,120	16.539	295
M	492.25	4,392,131,445	23.3449	72	925	12,300	13.831	316
N	197 00	1,676,049,171	30.9620	60	686	8,650	7.708	250
O	239.47	2,182,337,109	17.3170	90	1,170	7,629	9.970	305

One of the reservoirs planned by Mr. Craven has been constructed at Boyd's Corner, in Putnam County, by General George S. Green. The dam is placed across the west branch of the Croton, twenty-three and three-quarter miles from the Croton dam; it is six hundred and fifty feet long and sixty-four feet high, and the reservoir covers an area of three hundred and three acres. It contains 3,369,000,000 gallons of water, a quantity sufficient to supply the city thirty-three days, with its present population. This reservoir alone will carry the city through the longest drought which is liable to occur. As the population of the city increases, it will merely be necessary to construct a new reservoir from time to time. In fact Mr. E. H. Tracy, the present engineer of the Croton Department, is now engaged in constructing a second of these reservoirs, the position of which is indicated on the map.

The aggregate capacity of these fifteen reservoirs is 67,000,000,000 gallons, or two years' supply for the city of New York! It may be asked, Does a sufficient quantity of water fall in the region to fill such a series of reservoirs?

I reply, that the area of the Croton water-shed is $338\frac{82}{100}$ square miles, with an elevation of from two hundred and fifty to six hundred feet above the sea level, and the average rain-fall forty-eight inches. The following table, kindly communicated by Mr. John C. Campbell of the Croton Department, shows the monthly rain-fall at the new reservoir in Putnam County, for the past eight years.

RAIN-FALL. — *Storage Reservoir at Boyd's Corners, Putnam County, New York. From January* 1, 1866, *to January*, 1874.
Including Melted Snow.

Altitude of station above tide-level, 600 feet.

MONTH.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.
January	3.33	2.11	2.90	3.79	4.51	3.80	1.44	5.66
February	3.60	3.00	1.38	3.64	6.40	3.81	1.22	3.69
March	3.33	1.49	2.55	5.48	3.80	4.27	2.59	3.08
April	3.79	3.74	3.87	2.11	5.45	3.01	3.04	3.77
May	5.62	6.86	8.79	4.52	2.30	3.45	3.69	2.91
June	4.45	5.28	4.53	3.59	2.06	5.73	4.00	0.71
July	4.01	5.25	2.13	2.26	3.43	5.07	4.34	2.21
August	6.56	10.04	6.98	1.92	5.10	5.24	5.99	5.73
September	4.92	3.62	9.33	3.20	2.85	1.44	3.69	3.73
October	5.09	3.66	0.87	9.46	4.73	6.18	2.15	5.13
November	3.80	3.10	4.65	2.43	2.51	4.35	4.91	3.72
December	3.27	2.62	2.35	5.96	1.49	2.59	3.68	4.13
Total	51.77	60.77	50.33	48.36	44.63	48.93	40.74	39.73

Average for eight years . . . . 48.15 inches annually.

The following table, for which I am indebted to engineer W. W. Wilson, shows the monthly rain-fall at Sing Sing, and the percentage of water collectable, during the year 1871. The third column exhibits the estimated percentages of rainfall collectable in the valley of the Sprains at Yonkers, N. Y.

Rain-fall at Sing Sing, 1871.

Month.	Rain-fall in inches.	Percentage collected.	Percentage of Sprain collectable.
January	2.64	50	18
February	3.38	59	59
March	6.21	108	158
April	3.51	90	93
May	4.13	80	99
June	9.01	38	18
July	5.41	10	7
August	4.78	17	15
September	2.15	25	40
October	8.30	30	28
November	6.20	40	77
December	2.18	85	85
	57.90	49	

From this table it appears that forty-nine per cent. of the rain-fall can be collected and held, provided there is storage capacity to hold it till it is required for use.

Each inch of rain-fall is equivalent to $\frac{5280\times5280\times144}{231}$ = 17,378,742 gallons on each square mile of surface. On the 338.82 square miles of the Croton water-shed each inch of rain would deposit 5,888,165,364 gallons. The forty-eight inches average rain-fall for the past eight years supplied 282,631,-937,472 gallons per annum or 774⅓ million gallons daily. Assuming that one half this can be collected, we have an available supply of 387,000,000 gallons daily, or nearly four times our present consumption, a quantity sufficient for four million inhabitants, at the present rate of supply. The present supply of water is very liberal, amounting to 100 gallons per head daily.[1] Imperial Rome received, however, 300 to 340 gallons per head daily.

Few cities at the present day are as liberally provided as New York. The supply of

	Gallons.
Manchester, in 1852, was	50
Liverpool, " 1862, "	30
Edinburgh, " 1852, "	30
Glasgow, " 1862, "	50
London, " 1862, "	50
New York, " 1874, "	100
Imperial Rome	300 to 340

It has been frequently proposed of late to place water-meters in every building in the city, and tax the citizens in proportion to the quantities of water actually drawn through them. This measure, it is claimed, will prevent the present waste of water. There is an air of justice, too, in the proposition to charge the customers for the water actually used. Persons may be wasteful if they choose, but they must pay for the privilege.

In my opinion, however, this proposition, except as far as it relates to

[1] Besides 12,000,000 pumped from tube (driven) wells, for the use of factories, etc.

factories, breweries, stables, etc., cannot be too strongly condemned. Pure water is hardly second to pure air as a life-giving and life protecting agent. It is the most potent servant the sanitary authorities can call to their aid. To measure out and sell, by the gallon, this bountiful gift of the Creator, would be a crime against the people. It would be in direct opposition to the current of modern civilization, only to be compared, though really a much more serious act, to the tax on windows, which, not a great while ago, compelled people to exclude the blessed light of day from their dwellings, and led architects to adapt their style of architecture to the obnoxious law.

We have already seen that the water-shed of the Croton, with its three hundred and thirty-nine square miles of area, is capable of supplying water for a city of four millions of people, and that the erection of a few dams will secure reservoirs capable of storing this supply. Let the money, then, that would be spent in purchasing costly water-meters, which are five times as expensive as gas-meters, be spent in constructing another of these dams, to give us all the water we need. There is no earthly reason why our water supply should be limited, unless possibly for the benefit of the owner of some patent meter. I speak advisedly on this subject, having been over the ground and seen the sources of supply with my own eyes. We should never consent to see the poor deprived of so essential a source of health and happiness, as pure and abundant water. On the contrary, there is no object for which the public funds can be more legitimately expended, than for increasing the facilities for using water, by the establishment of free public salt and fresh water baths. Why should we of free America, in the nineteenth century, be behind Rome in the days of the Cæsars?

Purity of the Croton Water. — The character of the Croton water-shed is of a nature to guarantee water of the best quality. Mountains and hills of Laurentian gneiss receive the rain-fall, which is quickly absorbed and filtered by the pure siliceous sands and gravels, to gush out in numberless springs, feeding the brooks which bear the sparkling waters to the ponds, which serve as natural storage reservoirs. From these flow the large streams, which by uniting form the Croton River. This is finally expanded by the dam at the head of the aqueduct, into a broad deep lake, the *fountain reservoir*, or *Croton Lake*, in which the quiet waters deposit the finer sediments, and thus undergo a final purification before they are admitted to the aqueduct.

Nowhere along the streams can anything be found which can render the waters impure. Rugged rocks or bright green pastures generally border them. A few factories have been located at points where the water power is available, but a careful examination failed to reveal any pollution of the water by them.

Swamps occur in some portions of the water-shed, where the waters linger on peaty deposits; but as already stated, from such vegetable matters nothing is taken by the water that can in any way render it unwholesome. At certain seasons of the year, as when the snow melts in the Spring, and the waters scour the still frozen earth, the water is often discolored when it reaches the city, and alarmists begin to discuss the dangers to be appre-

hended from the poisons and miasmata which are derived from the bogs and morasses of Westchester and Putnam counties. But we have never been able to trace any sickness whatever to such sources, and do not believe that any unwholesome impurities ever occur in our water.

The purity of the Croton water is remarkable; if you glance at this diagram, you will see the quantities of the different substances obtained from one United States gallon of two hundred and thirty-one cubic inches, in 1869 and 1872:—

Solids contained in One Gallon of Croton Water.

	Summer, 1869.	May 11, 1872.
	grains.	*grains.*
Soda	0.326	0.157
Potassa	0.097	0.109
Lime	0.988	0.819
Magnesia	0.524	0.369
Chlorine	0.243	0.172
Sulphuric Acid	0.322	0.124
Silica	0.621	0.222
Alumina and Oxide of Iron	a trace	0.058
Carbonic Acid (calculated)	2.604	2.074
Water in Bicarbonates (calculated)	0.532	0.421
Organic and Volatile Matter	0.670	0.874
	6.927	5.399
Less Oxygen, equivalent to the Chlorine	0.054	.039
Total	6.873	5.360

These acids and bases are probably combined in the water as follows: —

	Summer, 1869.	May 11, 1872.
	grains.	*grains.*
Chloride of Sodium	0.402	0.284
Sulphate of Potassa	0.179	0.205
Sulphate of Soda	0.260	0.024
Sulphate of Lime	0.158	0.024
Bicarbonate of Lime ($CaO,HO,2CO_2$)	2.670	2.331
Bicarbonate of Magnesia ($MgO,HO,2CO^2$)	1.913	1 338
Silica	0.621	0.222
Alumina and Oxide of Iron	a trace	0.058
Organic Matter	0.670	0.874
Total	6.873	5.360

On evaporating a gallon of this water, a residue of only 4 78 grains is obtained, the bicarbonates of lime and magnesia being left as simple carbonates.

The following tabular statement shows how favorably the Croton compares with the waters supplied to other cities.

PURITY OF CITY WATERS. — *Impurities contained in one wine gallon of* 231 *cubic inches, expressed in grains.*

City.	Source.	Inorganic Matter.	Organic and Volatile Matter	Total Solids.
New York...	Croton, average for 13 weeks, 1867 (C. F. Chandler)..	3.90	0.66	4.56
New York...	Croton, average for 3 months, 1868 (C. F. Chandler)..	3.31	1.14	4.45
New York...	Croton, average for 6 months, 1869 (C. F. Chandler)..	4.11	0.67	4.78
New York...	Croton, May 11, 1871 (C. F. Chandler)..........	2.799	0.875	3.674
New York...	Croton, average for 5 months, winter 1871-72 (E. Waller)......................................	3.934	0.508	4.442
New York...	Well, west of Central Park (C. F. Chandler)......	38.95	4.55	43.50
Brooklyn	Ridgewood, average for 3 months, 1869 (C. F. Chandler)....................................	3.37	0.59	3.92
Boston	Cochituate (E. N. Horsford)	2.40	0.71	3.11
Philadelphia..	Fairmount, Schuylkill (E. N. Horsford)	2.30	1.20	3.50
Philadelphia..	Delaware (H. Wurtz)............................	2.93	0.55	3.48
Albany	Hydrant (E. N. Horsford)........................	8.47	2.31	10.78
Troy.........	Hydrant (W. Elderhorst)........................	6.09	1.34	7.43
Utica.........	Hydrant (C. F. Chandler)	5.50	0.96	6.46
Syracuse	New reservoir (C. F. Chandler)..................	12.13	1.80	13.93
Cleveland	Lake Erie (J. L. Cassels)........................	4.74	1.53	6.27
Chicago	Lake Michigan (J. V. Q. Blaney)................	5.62	1.06	6.68
Rochester ...	Genesee River (C. F. Chandler)..................	12.02	1.23	13.25
Schenectady ..	State Street well (C. F. Chandler)................	46.88	2.33	49.21
Newark .... Jersey City. Hoboken .. Hudson City	Passaic River (E. N. Horsford)..................	4.58	2.86	7.44
Trenton	Delaware River (H. Wurtz)	2.93	0.55	3.48
London	Thames (Dr. H. Letheby)........................	15.55	0.83	16.38
London	Well, Leadenhall Street (Dr. H. Letheby).... ...	90.38	9.59	99.97
Dublin	Lough Vartry, new supply (Apjohn and others)....	1.77	1.34	3.11
Paris........	Seine, above the city (Bussey, Wurtz, and Ville)...	7.83	1.00	8.83
Amsterdam ..	River Vecht (V. Baumhauer and Van Moorsel) ...	14.45	2.13	16.58
Amsterdam...	Deep well at the Keisergracht	64.55	4.38	68.93

You see by this table that the Croton compares very favorably in purity with the water supplied to other cities. I will call your attention specially to the sixth water on the list, that of the well west of Central Park. This water, you see, contains forty-three and one-half grains of impurities in one gallon, of which over four and one half grains are organic matter. You will not be surprised when I tell you that this well is situated in a shanty village, where cholera was a few years ago extremely fatal.

No one who has ever examined the district which supplies the Croton River will be surprised at the purity of the water as shown by analysis.

CONCLUSION.

In conclusion I would say that from the facts which I have presented it is evident that wells are always to be viewed with suspicion as sources of water supply, on account of the danger of contamination from the drainage of the soil about dwellings, and of the leakage from drains, cesspools, and privy vaults. Tube or driven wells are little better than open wells. The water of artesian wells is often excellent though sometimes too heavily charged with mineral salts to be available, except for medicinal purposes. For the supply of cities, lakes or rivers must be selected, and although rivers are the great natural sewers, and receive the drainage of towns and cities, the natural process of purification, in most cases, destroys the offensive bodies derived from sewage, and renders them harmless. In very rare cases will organic matters be derived from swamps and peaty deposits, and except that these bodies may sometimes discolor the water there is no sanitary objection to them.

Had time permitted I should have been glad to have discussed the subject of suitable pipes for distributing water in our houses, but this must be left for another occasion.